DEPARTMENT OF RECONSTRUCTION AND SUPPLY

Manpower and Material Requirements for a Housing Program in Canada

Published by Authority of
the Right Hon. C. D. Howe, M.P.,
Minister of Reconstruction
and Supply

CANADA

OTTAWA
EDMOND CLOUTIER, C.M.G., B.A., L.Ph.,
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
CONTROLLER OF STATIONERY
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FOREWORD

Houses, many thousands of them, are being erected all across the country. But many more are needed to provide housing of a desirable standard for all Canadians.

Improvement of living conditions for the Canadian people as it relates to housing has two aspects.

One pressing problem presents itself in the transition from war to peace, namely, the shelter problem. Homes have to be found for many thousands of families of returned veterans, war workers and others who, in their search for better economic opportunities have moved and are moving from rural to urban areas, or from the settled parts of the south to the northern parts of the country which are being opened up to mining and logging. This shelter problem has to be faced in a period when industry, in a state of reconversion and reorganization, is adjusting itself to peacetime production. Similarly, the realignment of the labour force to new jobs and new places is also a gradual process requiring time for adjustment. In many instances it means learning new trades, acquiring new skills and increased mobility. In the face of these conditions, only basic needs for shelter can be met. This means building as many permanent homes as can be done with the available supply of manpower and materials, and providing for temporary housing accommodation to tide us over the emergency period.

The second problem is a long-term one. After the basic need for shelter is met, the quality of housing has to be improved, and adequate living accommodation made accessible to every family in the country. This achievement will take considerable time, but a substantial contribution can be made towards it by maintaining a high level of residential construction over a long period. At the same time, while setting the improvement of housing standards as a task of high priority, we must remember the contribution which a large housing program makes to the level of employment and income of the country. In other words, a housing program has to be fitted into the wider framework of an economic policy aiming at high levels of employment and income.

Before annual programs for future years can be formulated, a number of complex matters have to be considered. These include measures of the need for housing accommodation for new families, for additional homes required to reduce overcrowding, for the replacement of obsolete and sub-standard dwellings, and for allowance for a minimum vacancy rate to assure flexibility in our housing supply. In addition, account has to be taken of economic conditions in Canada, particularly of the ability of the population to acquire new houses or rent new homes, of the capacity of the construction industry and ancillary industries supplying building materials, and of the supply and skill composition of the labour force in building operations and in the ancillary industries. At the same time, consideration has to be given to the contribution of the housing target to the level of economic activity in terms of providing jobs and demands for materials and services.

In the present transition period, when scarcity of labour and materials is our main limiting factor in setting an adequate housing target, it is essential to know the number of men required and the quantities and kinds of materials needed to accomplish a given housing target. Similar information is also needed to permit appraisal of the effects of a long-term housing program on the level of economic activity, in particular through its contribution to the level of employment, both in the construction industry and the industries supplying

building materials and services. To serve both these purposes, this research study on the "Manpower and Material Requirements for a Housing Program in Canada" has been undertaken by the Economic Research Branch of the Department of Reconstruction and Supply.

The report deals first with considerations which led to the setting of the housing target during the transition period and its close tie-in with industrial capacity and availability of labour. It then indicates the factors that affect the composition of the housing target, and gives overall estimates of material and manpower requirements for housing targets varying in dimensions between 50,000 and 80,000 units per year. Construction costs as a factor in the housing program, and the long-term need for increased efficiency in the building industry are discussed next. Variations in the employment content in the different types of houses, and on-site and off-site employment are then examined. The report concludes with an analysis of the factors which determine effective demand for building materials, and provides detailed estimates of requirements for the different kinds of building materials. The study is confined to the demand side for manpower and materials, with the supply side being the subject of another inquiry. However, and this is of particular importance in considering the dimensions of a housing program for Canada, the present inquiry brings out the fact that a housing target of 60,000 units during 1946-1947 is well within the productive capacity of this country. In the years to come even larger housing programs should be within our reach.

The success of a housing program in the transition period depends in the main on the co-ordinated effort of management and labour in the construction industry and the industries that supply needed building materials. It is primarily for the guidance of industry that the results of this research study are published—to assist it in the responsible task of providing the tools needed to accomplish a desirable housing target in 1946-1947 and the years that follow.

C. D. Howe, M.P.,
Minister of Reconstruction and Supply

Ottawa,
September 15, 1946.

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ACKNOWLEDGMENT

This research study is the result of a joint effort by engineers, architects, practical builders, economists and statisticians who contributed to a common pool of specialized knowledge of certain aspects of the problem in an attempt to present as complete a picture as possible of the manpower and material needs of a housing target in Canada. Mr. James Adam, formerly Chief Technical Director of Construction Control, Department of Munitions and Supply, acted as technical adviser in this study. Great assistance was also rendered by a number of general contractors and house builders, particularly Mr. J. L. E. Price and Mr. John Leitch, both of Montreal; and by Mr. J. O. Kemp of the Chief Architect's Branch of the Department of Public Works. The Dominion Bureau of Statistics, the Department of Labour, the Wartime Prices and Trade Board and the National Housing Administration supplied useful information for incorporation into this study.

The report was prepared by Dr. O. J. Firestone, Director of Economic Research, Department of Reconstruction and Supply, assisted by Miss B. A. Steinbach and Mr. S. Trachtenberg.

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SCHEDULE IN TEXT

NB v option of ↑ multiple household dwelling ↓ pursued, even tho' they cost much less Cf. 40

SUMMARY

Canada's population of twelve million lives in some two and three-quarter million dwellings, but several hundred thousand more homes are required to meet the most pressing housing needs of the country.

The housing shortage of to-day is due to a number of reasons: the small volume of new residential construction during the prolonged depressed conditions of the 'thirties, curtailment of house-building activity during the war years due to the need for directing large segments of manpower and industrial resources towards the full prosecution of the war, the concentration of war workers in the larger industrial centres, the return of war veterans endeavouring to establish new households, the natural increase in population and high marriage rate during the war years. Another important factor is the high level of national income. As a result, many families, formerly sharing housing accommodation with other families, are endeavouring to obtain separate dwellings.

Various Government measures have been and are being taken to assure for the immediate future the building of as many houses as can possibly be done with the manpower and materials available for house building in the country. A minimum target of 50,000 units has been set for 1946, the first full construction year following V-E Day, having due regard for the needs of skilled labour and materials required by industry converting from war to peace, or modernizing or expanding its productive facilities essential to the maintenance of a high level of employment and income in the transition period. With a co-ordinated effort it should be possible, however, to reach a higher housing target of 60,000 units. Whether such a desirable target can be accomplished depends on the ability of management in the construction industry to organize the undertaking of house building on a large scale. Success in achieving this target depends also on the availability and ability of construction workers and their willingness to co-operate, coupled with the ability of industry and governments to train and upgrade as many new construction craftsmen as possible and assist in the re-training of many veterans desiring to establish themselves in the construction trades. It will succeed only if the industries turning out needed building materials make fullest use of their capacities and create new or expand existing facilities, where these do not meet the demand. It will necessitate a maximum effort on the part of all men and women in the professional, commercial, clerical and labouring fields who, either directly or indirectly, contribute to the making of a house. But whether the minimum target of 50,000 units or the desirable target of 60,000 units is reached, the number of new houses constructed will not meet all the urgent needs. However, this target, if accomplished, will mean a great improvement over conditions of to-day, with further relief of the housing shortage in sight for the years that follow.

A number of measures have been and are being taken by the Dominion Government to stimulate housing construction. Builders and construction workers alike are being encouraged to build as many houses as possible. Some direct public building is being undertaken under Wartime Housing Limited and the Veterans' Land Act Administration. Fiscal and credit measures have been introduced in an endeavour to encourage management and labour in the industries producing building materials to do so to the maximum of their ability. Facilities for the undertaking of large-scale housing projects (through limited dividend corporations and insurance company housing) have been provided, as well as assistance rendered in the purchase of individual homes through financial and other provisions.

To enable management and labour in the construction industry and those sections of the economy concerned with the production and distribution of

building materials to make adequate preparations for the very substantial tasks ahead, this study provides detailed information on the requirements of manpower and different kinds of building materials needed to construct 50,000, 60,000, 70,000 and 80,000 housing units in this country.

Briefly, here is what the construction of 50,000 housing units means to the Canadian economy:

(1) New homes for about 200,000 people.

(2) Jobs for one year for between 134,000 and 162,000 men. Of these, 62,000 to 75,000 men would be working directly on the building sites while between 72,000 and 87,000 persons would be working in the industries supplying building materials and transportation services. The total number employed would approximate the number of persons working on the combined production of aircraft, guns, shells, bombs and explosives at the peak of war employment in the second half of 1943.

(3) A total annual payroll to construction workers varying between $103 million and $125 million.

(4) Orders for building materials to manufacturers and distributors, including transportation costs to the site, varying between $144 million and $175 million, with nine major supply industries participating as follows:

(a) Cement, gravel and sand	$11.0 million—	$13.3 million
(b) Brick, tile and stone	7.2 million—	8.7 million
(c) Lumber and its products	61.5 million—	74.7 million
(d) Lath, plaster, stucco and insulation materials	16.3 million—	19.8 million
(e) Roofing materials	4.2 million—	5.1 million
(f) Paint and glass	4.6 million—	5.6 million
(g) Plumbing and heating equipment and fixtures	26.9 million—	32.5 million
(h) Electrical equipment and fixtures	5.6 million—	6.8 million
(i) Other building materials (mainly steel and metal articles)	7.1 million—	8.7 million

(5) Earnings by contractors and builders (overhead and profits) varying between $28 million and $33 million.

(6) Total construction expenditures varying between $275 million and $334 million, close to the expenditure for Canada's shipbuilding program (merchant marine and navy) during 1943, the year of peak production, when the program involved over a million tons of shipping.

(7) Real estate transactions ranging from $27 million to $33 million.

(8) Added incomes to professional people such as architects, lawyers, surveyors.

(9) Improvement of the fiscal position of many municipalities because of increased revenues and the spreading of the burden of maintaining and expanding public facilities among a larger number of home owners.

(10) Substantially expanded business activity among lending institutions which are responsible for financing a major part of the housing program in Canada.

The above figures have to be raised by 20 per cent for every additional 10,000 houses built in the country. Apart from the direct effect of the housing program enumerated above, very substantial indirect effects will result from large-scale house building contributing to increased economic activity among a great number of trades and businesses in practically every part of the country.

Shortages of certain building materials and lack of sufficient skilled construction workers are great obstacles to be overcome in the execution of a large-scale housing program in the transition period. High construction costs is another obstacle, particularly to a large housing program on a continuing basis.

Construction costs have risen since the outbreak of the war, mainly for two reasons:

(1) Increase of prices of building materials and of hourly wage rates paid to construction workers. From 1939 to 1945, the former increased by 42 per cent and the latter by 31 per cent. For the cost of an individual housing unit, this means an increase of about 37 per cent (weighted average). This rise in cost is substantially in line with the increases in earnings and the general increase of prices and wages in other sectors of the Canadian economy and is, therefore, likely to be maintained for some time to come.

(2) Lowering of efficiency in the house-building industry owing to special conditions arising out of the war. This decline in efficiency was mainly due to the dilution of the skilled working force by untrained or partly trained men and delays on the building site due to shortages of building materials. Contingencies of this sort have caused a rise in construction costs varying, in most cases, between 10 and 25 per cent. This additional increase is considerably out of line with increases in costs of other products.

Taking *all factors* into account, total building costs have risen between 47 and 62 per cent from 1939 to 1945, and a further rise is indicated since. Not until efficiency in building operations increases over present levels can any substantial reduction of war-inflated building costs be expected. But part of such a decline might be offset, in the immediate future, by a further rise in prices of building materials and wage rates paid to construction workers.

The key to success of a national housing program lies in regional and local co-operation. Not only regional and civic authorities, but also professional men, business men and workers alike will have a keen interest in the housing needs of their communities, and they may want, possibly through their representative organizations, to assess the resources of their area to see what portion of the housing needs of the locality can be filled in the course of the next year and the years that follow. Taking stock of capacity and setting it against requirements will indicate how much can really be done with the existing facilities. In a number of cases such stock-taking will lead to expansion of capacity where the expansion is justified by the long-term building prospects in that locality—and perhaps surrounding areas. A definite procedure to accomplish such stock-taking is outlined in this study (see Appendix C).

The difficulties which a large-scale housing program faces in the immediate future and for some years to come are formidable. But Canada has met, to the fullest extent of her capacity, the call from her own armed forces and those of her Allies for enormous quantities of war material and equipment. To accomplish this, the productive facilities of the country were greatly expanded and added skills were acquired, bringing to Canada new industrial strength never before attained in her history. Now this newly-gained industrial strength is being challenged by the need for an all-out effort on the housing front.

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CHAPTER I. THE HOUSING TARGET

The housing problem during the first few years following V-J Day is an emergency problem that has arisen out of the contingencies of almost six years of war and omissions in the years prior to the war. The immediate problem, therefore, is one of increasing the supply of shelter as distinct from the replacement and improvement of existing housing, with attention to these problems being deferred to a later time when the housing emergency has been overcome. Overcrowding existed before the war and so did slums. The need for devoting all available resources—manpower, industrial capacity and natural resources—to the prosecution of the war made it necessary to postpone to the years of peace any large-scale measures to alleviate these conditions. With building activity of necessity at moderate levels during the war years, all that could be done without impeding the war effort was to lay plans for as large a housing program after the war as would be compatible with the available supply of labour and materials.[1]

In setting a housing target in the immediate post-war period account has to be taken not only of the housing needs arising out of omissions in the past, but also of the amounts of materials and labour required for the reconversion, expansion and modernization of Canadian industry regarded as essential to the orderly transition from war to peace and to the maintenance of a high level of employment and income in the country.

1. *Irregularity of New Residential Construction*

During the inter-war period, the volume of new residential construction varied substantially from year to year. New housing units numbering an estimated 32,000 were built in urban areas in 1922, increasing to 50,000 units in 1928. By 1933 they were down to 14,000. House-building activity increased slowly in the following years so that by 1939 housing construction had only again reached the level of activity in 1922. The average number of houses built in urban areas in Canada during the years 1924-1939 was 32,000. This level of house-building activity was below that of the United States and England and Wales. If adjustments are made for differences in population, a comparable figure for the United States during the same period would be 42,000 units and for England and Wales, 63,000.[2]

The substantial volume of house building in the 'twenties took place in a period when the Canadian economy was expanding and business prospects were favourable. Prices were high, making enterprise pay. World markets were buoyant, willing to absorb from Canada large quantities of raw materials and agricultural products. Take-home pay of a substantial section of the population

[1] An integrated housing policy has been taking shape at the Federal level. In March, 1944, one of the most extensive inquiries into the Canadian housing problem was completed with the publication of *Housing and Community Planning*, Final Report of the Subcommittee, Advisory Committee on Reconstruction (Ottawa, King's Printer, 1944). The report suggested the development of a twenty-year housing program and submitted a large number of legislative proposals considered desirable to achieve an integrated housing policy. Taking account of many of the recommendations of the report, the Dominion Parliament, in August, 1944, passed a revised National Housing Act, which made comprehensive provisions for the financing of housing construction (both for ownership and rentals), home improvements, encouragement of production of special material and equipment for farms, and research in housing and community planning (8 George VI, chap. 46, and amendments). In December, 1945, the Central Mortgage and Housing Corporation Act was passed. This Act provides facilities for re-discounting of mortgages by lending institutions, financial research, and sets up a separate agency for the administration of national housing legislation (9-10 George VI, chap. 15). In April, 1946, under Order in Council P.C. 1513, the function of the Central Mortgage and Housing Corporation and the administration of the National Housing Act, as well as other housing regulations, e.g., Emergency Shelter regulations, were transferred to the Minister of Reconstruction and Supply, who was already responsible for operations under Wartime Housing Limited, a Crown company engaged in the construction of low rental houses for veterans, and the administration of regulations dealing with the supply of building materials. Liaison was also established between the Central Mortgage and Housing Corporation and the Director of the Veterans' Land Act with regard to small holdings in or adjacent to urban areas to ensure co-ordinated action in the field of Federal housing. In June, 1946, the Central Mortgage and Housing Corporation became responsible for directing the policy and activities of Wartime Housing Limited. These steps have been taken in order to create a unified operating group in the housing field. As a result, provinces, municipalities, companies and individuals interested in housing deal with only one agency. In the same way, the activities of field representatives were co-ordinated.

[2] *Housing and Community Planning*, op. cit., p. 32.

was large enough to make many families aspire to home ownership or improved standards in their rental accommodation. The process of urbanization in Canada was continuing, as more and more people left the rural areas to find new jobs and homes in the cities and towns. At the same time, Canada's population increased both through natural increase and immigration. Thus, favourable economic conditions and bright prospects for the future meant a great impetus to housing construction in this period.

But the picture changed rapidly with the disturbances in business activity that followed the crash of 1929. A low level of housing construction during the 'thirties was only one of the indications of the prolonged depressed economic conditions of the last decade, as unemployment and low earnings affected both the urban and rural population. Canada's external trade shrunk considerably. International disturbances of trading caused a drastic curtailment of world markets. New tariff barriers and monetary disturbances made further inroads on the volume of Canadian exports. At the same time, great difficulties were faced internally in an attempt to readjust an economy so greatly dependent on trading with other countries. Other purely domestic factors, resulting in little new housing construction in the 'thirties, included a slow-down in the urbanization process, the glutting of the housing market for income groups which could afford new homes, substantial curtailment of immigration, postponement of marriages, and a generally lower standard of living.

2. *Deferment of Housing Construction During the War*

When economic conditions improved and business prospects became brighter towards the end of the 'thirties, the outbreak of the war of necessity interfered with any building plans that had developed and perhaps were close to the stage of execution. Canada's war effort during the period from 1939 to 1945 necessitated the diversion of a large segment of the productive capacity of the country to turning out materials and equipment for her own armed forces and those of the other allied nations. Consequently less building materials and fewer construction workers were available during these years to meet the need for new home building. A large-scale housing program had to wait until the conclusion of the war, when the reconversion of war capacity would make more materials and manpower available for civilian purposes.

How important this diversion was for the Canadian economy is illustrated by the following figures on the industrial war effort of this country. From some 100,000 at the beginning of the war, employment in war industry reached a peak of 1,166,000 in October, 1943. In 1943 and 1944, two-fifths of Canada's gross national product of $11.1 billion and $11.8 billion, respectively, was accounted for by Government war expenditures.[1] As military events turned more favourably for the Allies during 1944, some war production programs were curtailed and employment in war industry tapered off.

The impropriety of diverting labour and materials from the prosecution of the war to large-scale housing construction contributed to the supply of housing remaining far behind the demand. During the first few war years, increased individual incomes had caused sufficient undoubling to do away with vacancies, despite a reduction in the number of families requiring separate premises owing to large numbers of men enlisting in the armed forces. Greatly increased personal incomes had reduced even further voluntary multiple occupancy. House building was at a relatively low level owing to the need for materials for essential war purposes. It was not until 1944 that an appreciable number of houses was built. Then came demobilization with the very real need for dwellings for veterans who were reunited with their families. Already a need for housing units was being occasioned by the arrival of war brides in Canada. The

[1] *National Accounts, Income and Expenditure, 1938-1945*, Dominion Bureau of Statistics, Ottawa, 1946, p. 7.

continued high level of individual incomes was providing extra demands for housing. There was a continuation of the very high marriage rate with the result that net family formation was about twice that of 1939.

3. *Reconversion Basic to a Housing Program During the Transition Period*

It was not until the successful conclusion of the war was in sight that it was possible to divert some of the resources of the country towards meeting the most pressing needs of the domestic consumer. As manpower was released from the war effort it turned to peacetime assignments. Similarly, technical facilities becoming available were adapted to serve new tasks. The process of reconversion was gradual. At the conclusion of hostilities in Europe, on V-E Day (May 8, 1945), some 888,000 persons were employed in war industry. When the war ended in the Pacific on V-J Day (August 14, 1945) more than half of the peak working force, some 600,000 persons, was still engaged, either directly or indirectly, in war work.[1] While the reconversion process had by no means been completed by the end of 1945, a large segment of former war producers got ready to turn out civilian goods. At the same time the realignment of the working force had progressed sufficiently—in spite of a great number of difficulties, due to the need for occupational shifts and added mobility of labour—to permit increased output for peacetime uses.

By March, 1946, the economy had reached the middle of the transition. War production was virtually completed, most of the demobilization had taken place and firms that could switch readily to peacetime production had effected the change. Reconversion of production facilities of manufacturing industries formerly engaged in war production was about half complete. By August, 1946, one year after V-J Day, reconversion of these industries was approaching the three-quarter mark. But reconversion of productive facilities was only one part of the effort of manufacturing industries to gear their facilities for production for peacetime purposes. In addition, industry had prepared programs of modernization and expansion designed to make Canadian industry more efficient, to serve better the domestic consumer and strengthen the position of the country in international trade. A survey of manufacturing industries showed that no less than half of the firms surveyed were embarking on programs of modernization and/or expansion of their productive facilities in the post-war period.[2]

While the problems involved were numerous and supply and manpower shortages and some management-labour disputes were unavoidable, the progress of reconversion of manufacturing industries was being accomplished with speed and comparatively little dislocation. During the first year that reconversion was in progress, large numbers of men and women either in the armed forces or formerly employed in war industries had moved to the production and distribution of peacetime goods and services. Between June 1, 1945 and June 1, 1946, approximately 620,000 servicemen had been discharged and 720,000 persons had been released from war work. In spite of the magnitude of this manpower shift, the number of unemployed was kept surprisingly low, never reaching more than about 270,000 out of a total working force of close to 4·8 million persons. The peak level of transitional unemployment was reached in March, and by August, 1946, as the forces of expansion grew, unemployment had declined by 100,000.[2]

During the war years some industries made great technical progress while others remained in enforced inactivity. But with a return to peace, this inactivity was transformed into a definite trend to regain lost ground and to strengthen the industrial structure at all levels, managerial, technical and labour. Thus, a comparatively favourable climate for a gradually expanding housing program had been created.

[1] *Location and Effects of Wartime Industrial Expansion in Canada, 1939-44*, Department of Reconstruction and Supply, Ottawa, November, 1945, p. 28.
[2] *Reconversion, Modernization and Expansion, Progress and Programs in Selected Canadian Manufacturing Industries, 1945-1947*, Department of Reconstruction and Supply, Ottawa, August, 1946, pp. 7-8.

4. *The Immediate Housing Target*

The first peacetime housing target was set in April, 1945, at 50,000 units[1] for the first full construction year after the cessation of hostilities, a program moderately below the level of house-building activities in the best pre-war years, the late 'twenties[2]. It was acknowledged that such a program would fall short of the number of houses urgently needed, but it was deemed as large a program as could be undertaken with the expected supply of labour and materials during this period.[3]

Considering Canada's needs for manpower and materials required for the prosecution of the war and the partial reconversion of industry, the target set was a formidable one for the house-building industry which, in urban areas, where the bulk of new residential construction takes place, had been accustomed in the 'thirties to an average annual construction of about 32,000 units. The early conclusion of the war in the Pacific made it possible to aim at the completion of 50,000 units during the first year following V-E Day, that is, from May, 1945 to May, 1946, instead of the first full construction year which would have been the calendar year 1946. According to a survey made by the Dominion Bureau of Statistics, close to 48,000 units were completed during the calendar year 1945.[4] Present indications are that during the first year following V-E Day the target of 50,000 units has been substantially met. This, according to the Minister of Reconstruction and Supply, has been a creditable performance by the house-building industry.[5]

The accomplishment of this target has made a significant contribution towards easing existing housing shortages. It has not met all the urgent needs. The accomplishment of a larger target of some 60,000 units is feasible for the fiscal year April 1, 1946 to March 31, 1947, but whether this desirable target can be attained will depend on the speed with which industrial capacity can be organized to turn out more materials, and on the success of the various training schemes aimed at increasing the number of skilled building mechanics. The Minister of Reconstruction and Supply observed: "Our target of 60,000 units completed in the year ending March, 1947, and 80,000 in the year ending March, 1948, while in both cases beyond anything that prospects of available supplies now would warrant, will be short of requirements, even if the target can be attained."[6]

This target is in line with the needs for shelter faced by this country in the immediate future. As at March, 1946, Canada's immediate housing needs have been put by the Minister of Reconstruction and Supply at 150,000 units. This figure is equal to the number of houses which under normal conditions would have been built during the war years to keep up with the increase in the number of families. It does not take account of the need for the replacement of sub-standard homes, a certain amount of overcrowding that existed before the war and a desirable vacancy rate. This figure is supported by the results of a survey on doubling-up undertaken by the Dominion Bureau of Statistics in the spring of 1946. This survey showed some 210,000 single housing units each occupied by more than one family. Allowing for some voluntary doubling-up, the figure

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[1] Before V-E Day the Dominion Government announced on April 24, 1945, that it would "encourage" and "assist in the production of material and equipment for a total program of not less than 50,000 units in the first full construction year following the end of the European War." (White Paper on *Employment and Income with Special Reference to the Initial Period of Reconstruction*, Ottawa, April, 1945, p. 10).

[2] Between 1926 and 1929, urban house-building activity varied between 40,000 and 50,000 units annually, with the peak being reached in 1928 (*Housing and Community Planning*, op. cit., p. 32). These figures do not take account of construction in rural non-farm areas, e.g., unincorporated rural municipalities, mining centres, logging communities or fishing villages and in farm areas. The total net increase of dwellings in rural areas during 1921-1931 was about 100,000. Of this number, probably between 10,000 to 15,000 units were built annually in the late 'twenties. Thus the *total* number of housing units built in Canada during that period probably varied between 50,000 and 65,000 dwellings. These figures compare with the above mentioned target of 50,000 units for the first full construction year after V-E Day.

[3] *White Paper*, op. cit., p. 10.

[4] *Housing Statistics, 1946, Dwelling Units and Type of Buildings Reported by Municipalities for Four Months Ending April 30, 1946*, Dominion Bureau of Statistics, Ottawa, April, 1946, p. 4 (containing revised figures of the 1945 survey).

[5] The Rt. Hon. C. D. Howe, Statement in the House of Commons, *Hansard*, July 22, 1946, pp. 3734-3735.

[6] The Rt. Hon. C. D. Howe, Address to the Canadian Club, Toronto, April 15, 1946.

of 150,000 units suggested represents the minimum number required to meet the immediate shelter problem.

Starting with an immediate deficit of 150,000 units in the spring of 1946, some 15,000 units must be added for the needs created by men to be discharged and repatriated from the armed services. Allowance must also be made for an extra demand of some 15,000 units on account of 30,000 war brides, all of whom will have come to Canada before the spring of 1947. Experience has shown that about half the war brides create a need for additional housing units. Account should also be taken of the high marriage rate which continues to exist in Canada. For 1946 the number of marriages has been estimated at 105,000. Family dissolution continues at a rate of about 25,000. Net family formation is, therefore, taking place at the rate of about 80,000, of which perhaps 60 per cent creates a need for new family housing units. From these new requirements over the next year, some 50,000-60,000 units likely to be completed during the year ending March, 1947, should be subtracted.

These estimates, although approximate, indicate that by spring, 1947, an immediate housing deficit of some 180,000 units can be anticipated, or a worsening of the situation by some 20 per cent.[1]

5. *Long Term Housing Needs*

The question as to what comprises a reasonable estimate of housing needs for the five years ending spring, 1952, is a complex one. Even over as short a period as five years, there are many contingencies and uncertainties which have an important bearing upon the estimate and indeed make any such estimate hazardous. The level of employment and income over the next five years will, perhaps, be a most important influence, not only on the probable level of new housing during that period, but also upon the need for new units. The rate of recognition of obsolescence and depreciation will be another important factor. The taste in housing of the average citizen will also have a bearing.

In commenting on the long-term needs of the country the Minister of Reconstruction and Supply stated: "The Advisory Committee on Reconstruction in its report, commonly known as the Curtis report, indicated that the desirable housing program for the first ten years following the conclusion of the war would be 700,000 units or 350,000 units for a five-year period. But this estimate does not take account of all the doubling-up which we are experiencing and a desirable vacancy rate needed to assure flexibility in our housing supply. If account of these additional factors is taken, we estimate that we should build some 480,000 units during the five years ending March, 1952. About 80,000 units should be built during 1947-1948 and 100,000 in each of the following years. While this appears to be a very substantial target for the house-building industry whose present capacity is perhaps only a little more than half, I submit that such a target can be accomplished if we make an all-out effort on the housing front. As I shall outline, the Dominion Government is creating conditions favourable to a large housing program by private individuals and companies in Canada. While the Dominion Government will continue to give as much assistance as possible, both financial and physical, it is necessary for industry itself to increase its capacity to meet the housing needs of the country in the years to come."[1]

6. *Administrative Measures*

Various Government measures have been taken and are being taken to eliminate bottlenecks which would hamper the accomplishment of the housing target for 1946-1947. To encourage training in construction trades, the

[1] The Rt. Hon. C. D. Howe, op. cit., *Hansard*, p. 3735.

Dominion Government entered into a ten-year agreement with the provinces in 1944. According to this agreement, the Dominion Government provided a fund of upwards of $1 million to assist the provinces in the expansion of training facilities.[1] Special provisions were also made for veterans. By March 31, 1946, 6,785 apprentices were reported by the Department of Labour to be in training, about three-quarters of them being veterans.

While satisfactory progress has been made in the field of apprenticeship training, the results of the program will not be felt for some time, because it takes several years until the training is completed. However, because of shortened training requirements for veterans with some previous experience, a continuous flow of trained building mechanics is expected, beginning in 1947.

While training of construction craftsmen is one important element in contributing to the efficiency of the industry, co-operation among the different groups in the industry is also important. To stimulate co-operation among management, labour and government in the construction industry, the Dominion Government established some time ago the National Joint Conference Board of the Construction Industry. This Board, which came into existence during the war years, is continuing its operations, and has been able to do a great deal to foster co-operation in the industry.

In the field of building material supply a number of investigations were made to determine the difficulties which some manufacturers face in increasing their output. Steps taken to alleviate such difficulties include adjustment of prices, allocation of raw materials, facilitation of imports of needed machinery and equipment, and other measures. Still other provisions were made to encourage expansion of production, such as fiscal measures, e.g., special depreciation allowed under the Income War Tax Act,[2] and new credit arrangements, e.g., loans by the Industrial Development Bank[3]. In taking appropriate action to increase the supply of building materials, the Dominion Government has had the advice of the Committee on Materials of the Canadian Construction Association. An executive committee to expedite the flow of building materials has been set up within the Federal service. It is made up of the Co-ordinator of Housing and the Priorities Officer, both of the Department of Reconstruction and Supply, and the Co-ordinator of Capital Equipment and Durable Goods of the Wartime Prices and Trade Board. This committee is charged with the responsibility, in co-operation with the building industry, of increasing the supply of building materials, particularly those of a critical nature. It is busy on the reclamation of existing materials, as well as the co-ordination of priorities and controls. It is seeking to obtain the best use of the supply of building materials in the interest of housing as well as the industrial and commercial building required to maintain a high level of employment and income.

To assure that the housing target contains a certain number of moderate cost dwellings, special provisions are made for the execution of large-scale housing projects by private individuals and companies. Under the Integrated Housing Plan, financed under the National Housing Act, 1944, contracts which contain the provision that the builder will hold down the price of the house within the means of people with moderate incomes are concluded with builders. If the builder accepts this provision, he is not only provided with assistance in the financing of the projects and a guarantee against loss, but also with priorities to obtain the necessary building materials. Veterans and their dependents have first call on houses built under this plan. Another plan of a special nature is the formation of Housing Enterprises Limited, a company formed by a group of insurance companies willing to enter the field of housing construction on a large

[1] Scheme instituted under Order in Council P.C. 8993-1944.

[2] Under the provisions of Orders in Council P.C. 8640-1944, and 1449-1946, special depreciation is allowed to all manufacturers making investment for purposes of expanding, reconverting and modernizing their plants and equipment.

[3] The Industrial Development Bank assists firms in financing new investments or expanding existing plants under conditions which they cannot obtain from the commercial banks.

scale. Housing developments planned by this company include single units, multiple units and apartment houses, to be leased, whenever possible, at moderate rental to veterans and their families. The Dominion Government is directly concerned with the building of houses through Wartime Housing Limited, and the administration of the Veterans' Land Act. Wartime Housing Limited is building low rental homes for veterans and their families, and under the Veterans' Land Act, homes with small holdings near urban centres are made available for acquisition by veterans.

A building material priority system is in operation to provide the materials needed for the construction of houses under the plans enumerated above. This scheme is designed to assist in channelling the required quantity of materials into approved low cost housing projects in order that such projects may be completed as expeditiously as possible. With certain exceptions, a Priorities Order requires suppliers of building materials to make prior shipment of all purchase orders carrying a Government approved priorities rating.[1] In March, 1946, special provisions were made by the Department of Reconstruction and Supply to assist in the completion of homes for individual veterans of World War II by establishing procedure to obtain the remainder of building materials required to make ready for occupancy houses which are at least 75 per cent completed. In July, 1946, this scheme was extended to cover veterans' houses only 50 per cent completed, defined as houses "roofed and ready for plaster."[2]

Control by municipalities of non-essential or industrial construction has been provided for by an Order in Council[3] whereby municipalities are authorized to exercise control over erection, alteration or repair of buildings. During the current calendar year every municipal body has power to refuse to issue a permit and to revoke, cancel or suspend any permit which may have been issued for the erection, alteration or repair of any building or structure.

The action taken so far, or contemplated for the future, provides the framework within which a desirable housing target can be accomplished. But it will be difficult to attain any of the targets set if the present effort slackens and some of the existing bottlenecks are not overcome. On the other hand, given an increase in productive capacity, a readiness on the part of management to organize sufficiently to meet the challenge of a large-scale housing program, and a willingness on the part of workers to co-operate in the execution of the target, the sights set for the future should be within reach of the Canadian economy.

The following sections indicate the dimensions of the effort required in terms of costs, materials and manpower to build 50,000, 60,000, 70,000 or 80,000 housing units in Canada.

7. *Variations in Housing Standards*

If every house in Canada were built to meet a "desirable" standard,[4] the construction of 50,000 units would involve an expenditure of close to $334[5] million, or about $6,700 per unit. But since standards of construction are not uniform across the country, "actual" construction costs of a 50,000 unit program are likely to be below the above total and probably in the neighbourhood of $275 million, or an average of $5,500 per unit.[6]

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(1) Priorities Officer Order, No. 11-1946, Department of Reconstruction and Supply.
(2) The Rt. Hon. C. D. Howe, op. cit., p. 3740.
(3) Order in Council P.C. 1184-March, 1946.
(4) A house of a "desirable" standard is a dwelling built in a well-developed neighbourhood, with a sufficiently large building lot, containing adequately sized rooms, and one which is solidly constructed and well-equipped with modern conveniences and facilities. An indication of such standards is given by the National Housing Administration (see National Housing Act, 1944—*Minimum Standards of Construction*, N.H. 21-1945).
(5) Where figures are rounded to the nearest million or thousand, differences of plus or minus one will occur throughout the report.
(6) Because of outmoded by-laws in some urban communities, inadequate inspection in others, and the lack of building by-laws in many smaller centres, both urban and rural, "actual" standards are not always up to "desirable" standards (see also reference to average cost of "actual" standard houses in Note to Table 6, Appendix A).

A country such as Canada, with its wide expanse, its great variation in climatic conditions and economic opportunities, its marked differences in the composition of the population and their living habits, must, of necessity, build houses structurally quite diversified. Standards vary from a shoddily constructed house at the outskirts of a city to a luxurious home in a suburban community or an estate in the country. Varying standards in the types and sizes of structures erected result from kinds of building materials used and construction methods applied. Scarcity of building materials prevalent during the war years and likely to continue in certain lines for some time, has narrowed the range of variation, with comparatively few expensive houses being built. But in any attempt to estimate labour and material requirements of a housing program, cognizance has to be taken of the differences that do exist in the types of construction methods and in the kinds of building materials used in many houses built across the country. Only by taking account of the regional characteristics of Canada's housing program and the resulting differences in material and labour patterns can the overall requirements of a national housing program be determined. An attempt is made to accomplish this in the study by using a frequency distribution of seventeen different types of houses at present most commonly built in Canada. The pattern used here is based on experiences of the immediate past. Because of the possibility of changes in the pattern in future years, this study considers manpower and material requirements for 1946-1947 only. Although the same framework can be used, estimates for the years beyond this period will have to be revised in the light of changing conditions.

8. *Variations in Types of Structures*

Types of structure will vary from single family homes to large apartment blocks comprising a number of dwelling units. For statistical purposes these different types of structures have been separated into four major groups:

I. *The Single House.* This group comprises structurally separated units each of which is designed to provide living accommodation for one family or one household.[1]

II. *The Multiple Unit House.* This group includes duplexes, semi-detached houses, triplexes, double duplexes, terrace houses, sets of flats, row houses and small apartment blocks, all residential structures comprising at least two housing units and not more than six. It was found preferable to group small apartment houses of six units or less with duplexes and triplexes because they have much more in common in construction techniques with these structures than they have with large apartment houses which require strong foundations, heavier structural elements and—in most municipalities—fireproof construction.

III. *The Row and Apartment House.* Two different types make up this group of seven or more residential units: *(a)* the large row of houses, mostly an aggregation of one or two storey houses, and *(b)* the large apartment block, commonly found only in the larger cities, of solid and fireproof construction, frequently built with garages in the basement.

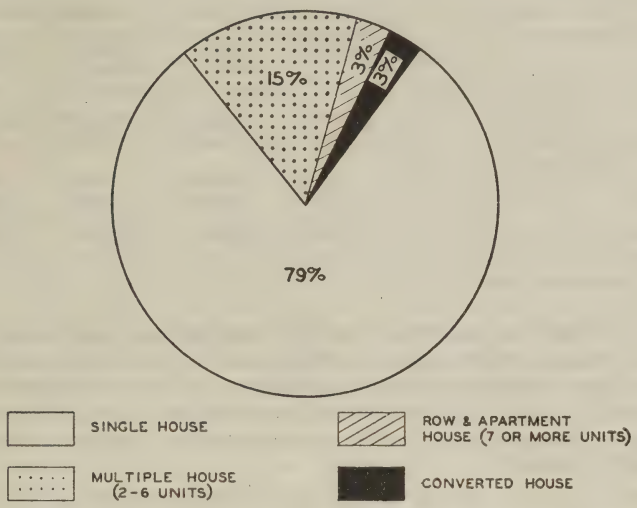
IV. *The Converted House.* This group consists of new units created by the conversion or remodelling of an existing building, usually a large one-family house, but occasionally an office building or similar structure. The existing exterior walls are used while the interior undergoes substantial changes to provide facilities for separate living quarters.

Using a sampling technique applied to applications for licences to the Construction Controller of the Department of Munitions and Supply, it was found that the majority of houses presently constructed in Canada are single

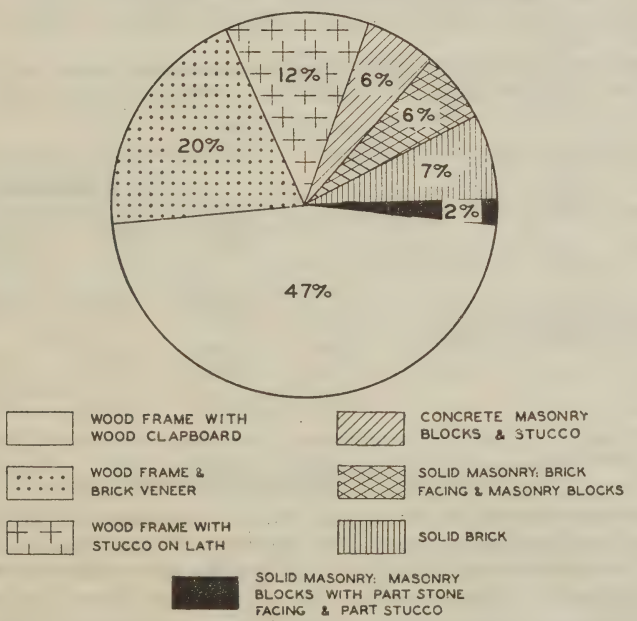
[1] The terms "house," "housing unit," "dwelling" or "unit" are used interchangeably throughout the study and refer to a separate set of self-contained premises of a residential character.

FIGURE 1 - HOUSING TARGET BY TYPES OF STRUCTURES AND BUILDING MATERIALS USED

TYPES OF STRUCTURES



BUILDING MATERIALS USED



SOURCE OF DATA: SEE APPENDIX A.

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houses. They made up 79 per cent of the total. Multiple houses comprising 2-6 units with an average of 3 units were next in importance with 15 per cent. They were followed by row and apartment houses of 7 or more units with the average row house containing 10 units and the average apartment block 16 units. This group and the converted house made up 3 per cent each (see Table 1 and Figure 1).

TABLE 1.—DISTRIBUTION OF HOUSING TARGET, BY TYPES OF STRUCTURES

Type of structure	Percentage distribution	Housing target			
		50,000 units	60,000 units	70,000 units	80,000 units
Single house	79	39,500	47,400	55,300	63,200
Multiple unit house (2-6 units)	15	7,500	9,000	10,500	12,000
Row and apartment house (7 or more units)	3	1,500	1,800	2,100	2,400
Converted house	3	1,500	1,800	2,100	2,400
Total	100	50,000	60,000	70,000	80,000

Source: See Appendix A.

Scarcity of building materials and building labour coupled with high building costs and rental control have in recent years been deterrents to the erection of large multi-unit residential rental projects. With land costs comparatively high for centrally located properties and the disappearance of some of the factors limiting large-scale residential building construction, the proportion of the latter group is likely to rise.[1]

Application of the above frequency distribution to a housing target of "desirable" standards comprising 50,000 units, indicates that some $282 million would be spent on single houses, some $40 million on multiple unit houses, some $9 million on row and apartment houses and about $3 million on converted houses, respectively, or a total of close to $334 million (see Table 2).

TABLE 2.—ESTIMATED CONSTRUCTION COSTS OF HOUSING TARGET, ON THE BASIS OF DESIRABLE STANDARDS, BY TYPES OF STRUCTURES

(Thousands of Dollars)

Type of structure	Percentage distribution	Housing target			
		50,000 units	60,000 units	70,000 units	80,000 units
Single house	84·46	281,849	338,219	394,589	450,958
Multiple unit house (2-6 units)	12·12	40,426	48,511	56,596	64,682
Row and apartment house (7 or more units)	2·59	8,658	10,390	12,121	13,853
Converted house	·83	2,778	3,333	3,889	4,445
Total	100·00	333,711	400,453	467,195	533,938

Source: See Appendix A.

9. *Variations in Building Materials Used*

Exterior construction in the houses built in Canada can be used to denote construction classification or type. On the basis of experience of administering applications for licences submitted to the Construction Controller of the Department of Munitions and Supply during 1941-1945, it was found that seven different

[1] This point is illustrated by statistics of the 1941 Housing Census which indicated that single units comprised a slightly lower proportion (71 per cent) of the total number of dwelling units.

types of houses were most commonly in use.[1] For purposes of convenience, each of these types has been designated with a code letter: Type A—wood frame with wood clapboard; Type B—wood frame and brick veneer; Type C—wood frame with stucco on lath; Type D—concrete masonry blocks and stucco; Type E—solid masonry: brick facing and masonry blocks; Type F—solid brick, and Type G—solid masonry: masonry blocks with part stone facing and part stucco.[2]

While the different kinds of exterior building materials can be expressed in terms of standard types, this cannot be done as readily for interior building materials used because of the greater variety of materials available and hence the possibility of substitution of one kind for another in case of shortages. In working out material requirements for the standard types used in the study, the most common interior materials were taken. It bears emphasis that some of these materials can be replaced by others if they are available within the same price range and provided they are about equal in terms of performance.

While in Group I (the single house) and in Group II (the multiple unit house) all seven types of houses differing in exterior building materials were quite commonly represented—though with greatly varying frequency—only two types were common for Group III (the row and apartment house). Most of the row houses were of wood frame and brick veneer construction (Type B) while most of the apartment houses were of solid masonry construction with brick facing and masonry blocks (Type E). Exterior materials are only of minor significance in determining building material requirements for housing conversion because the major part of the work is interior work (see Note to Table 3, Appendix A). A frequency distribution of the different kinds of materials used in house building among the four structural groups is given in detail in Table I, Appendix B. The distribution of the combined totals for the seven types is shown in Table 3 and Figure 1.

TABLE 3.—DISTRIBUTION OF HOUSING TARGET, BY KINDS OF BUILDING MATERIALS USED

Code	Kind of building material used	Percentage distribution	Housing target			
			50,000 units	60,000 units	70,000 units	80,000 units
A	Wood frame with wood clapboard	46·67	23,335	28,002	32,669	37,336
B	Wood frame and brick veneer	20·45	10,225	12,270	14,315	16,360
C	Wood frame with stucco on lath	12·15	6,075	7,290	8,505	9,720
D	Concrete masonry blocks and stucco	6·24	3,120	3,744	4,368	4,992
E	Solid masonry: brick facing and masonry blocks	5·92	2,960	3,552	4,144	4,736
F	Solid brick	6·84	3,420	4,104	4,788	5,472
G	Solid masonry: masonry blocks with part stone facing and part stucco	1·73	865	1,038	1,211	1,384
—	Total	100·00	50,000	60,000	70,000	80,000

Source: See Appendix A.

At present, almost four out of five dwellings built in Canada are of wood frame construction. The materials used for the exterior vary from wood clapboard (47 per cent) to brick veneer (20 per cent) and stucco on lath (12 per cent). The remaining dwellings comprise three types of about equal importance, each making up approximately 6 per cent of the total, including the concrete masonry blocks and stucco house, the solid masonry house with brick facing and masonry

[1] In some instances there were further variations of the seven standard types mentioned above but such houses were few in number and would, therefore, hardly affect the overall requirements of a large housing program.

[2] Houses with stone facing on all walls are not commonly built to-day, the prevalent practice being to cover one or three walls with stone facing. Accordingly, for the purposes of this study, the quantities of stone facing indicated for the Type G house have been taken as a representative average for this type of construction.

blocks, and the solid brick house. The fourth and last type, which is the least frequently constructed and makes up about 2 per cent of the total, is the solid masonry house of masonry blocks with part stone facing and part stucco (see Table 3 and Figure 1). Correspondingly, the largest proportion of outlay on a 50,000 housing unit program, namely, some $159 million, will go into the construction of wood frame houses with wood clapboard. About $60 million and $42 million, respectively, will go into the remaining two types of wood frame houses. Outlay for houses of other than wood frame construction is likely to be substantially smaller (see Table 4). The purchase of building materials for the different types of houses increases proportionately as a larger housing target is set (see Table 4).

TABLE 4.—ESTIMATED CONSTRUCTION COSTS OF HOUSING TARGET, ON THE BASIS OF DESIRABLE STANDARDS, BY KINDS OF BUILDING MATERIALS USED

(Thousands of Dollars)

Code	Kind of building material used	Percentage distribution	Housing target			
			50,000 units	60,000 units	70,000 units	80,000 units
A	Wood frame with wood clapboard	47·80	158,832	190,598	222,365	254,131
B	Wood frame and brick veneer	18·23	60,337	72,404	84,472	96,539
C	Wood frame with stucco on lath	12·82	42,461	50,953	59,445	67,938
D	Concrete masonry blocks and stucco	5·99	20,743	24,892	29,040	33,189
E	Solid masonry: brick facing and masonry blocks	5·91	20,310	24,372	28,434	32,496
F	Solid brick	7·11	24,302	29,163	34,023	38,883
G	Solid masonry: masonry blocks with part stone facing and part stucco	2·14	6,726	8,071	9,416	10,762
—	Total	100·00	333,711	400,453	467,195	533,938

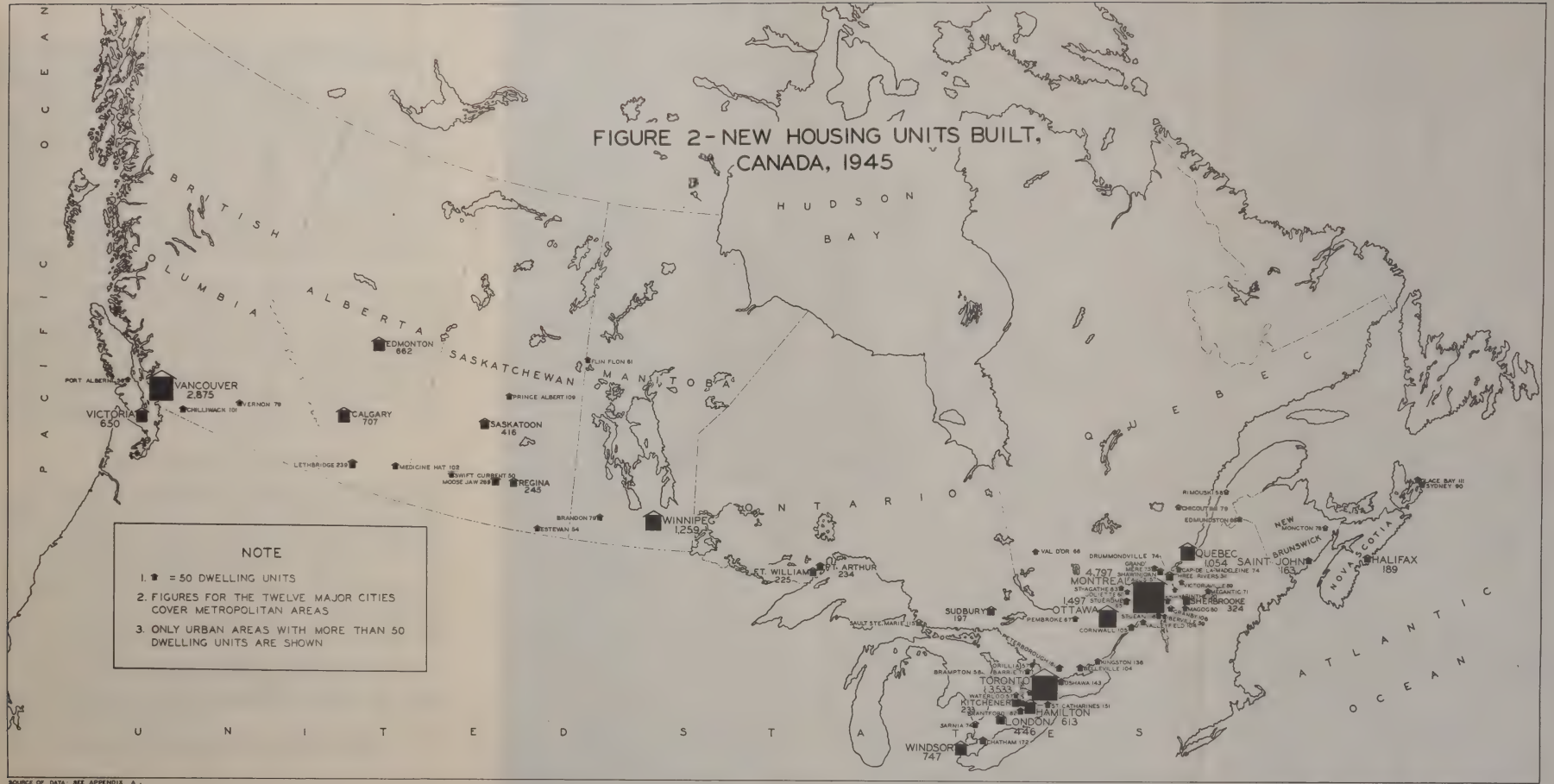
Source: See Appendix A.

10. *Regional and Local Variations*

Emphasis has already been put on the regional and local variation factors in terms of building costs, materials and labour requirements. In addition, there is a great deal of variation in efficiency and in prices of materials and wage rates which greatly affects cost differentials among individual projects.[1] Where possible, account of these factors has been taken in arriving at national totals for the country as a whole. But because figures given are national averages, they are not necessarily applicable to the particular conditions existing in one region or locality.

Since a national housing program is nothing but the sum total of dwelling construction in the different parts of the country, it is essential that estimates of overall requirements be supplemented, where possible, by regional and local estimates which can take account of the particular conditions prevailing in each area. The great diversification of house-building activity in Canada is illustrated by statistics of new housing units built (see Tables II and III, Appendix B, and Figure 2). This great diversification points to the need for refinement of the overall approach. Only by making regional estimates of requirements in terms of skilled and unskilled manpower and productive capacity, will it be possible to assess whether there are sufficient resources available in these areas to undertake housing construction to the extent desired. If it is found that insufficient resources are available, the question of expanding existing capacity,

[1] It has been attempted in this study to reduce this bias by estimating physical requirements and applying national average prices and wage rates to them.



SOURCE OF DATA: SEE APPENDIX A.

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the transportation of materials from other sections of the country or abroad, the substitution of obtainable building materials for a kind that is unobtainable, the training of construction workers and many similar questions will have to be examined before building bottlenecks can be removed.

How important it is to interpret a national program in terms of regional and local needs is illustrated by the following two examples: After overcoming all existing bottlenecks, it may be found that the country will produce sufficient bricks to construct an appropriate quota of a program of 50,000 housing units in one year. But if brick capacity is not evenly distributed, the outcome might be that some areas will have a surplus of bricks while others will suffer shortages. Because of high costs of transportation, moving of large quantities of bricks from one area to another is uneconomical. To take another example, wartime concentration of industrial labour has brought about a very substantial shift of Canada's working population. While training programs can help to increase the number of skilled construction workers, these workers may be unevenly distributed, with some constructon workers being unemployed in one area while badly needed in another. By *anticipating* likely requirements of building workers in particular areas, a great deal can be done to encourage mobility of labour in the direction most needed.

The key to success of a national housing program lies in regional and local co-operation. Not only regional and civic authorities but also professional men, business men and workers alike will have a keen interest in the housing needs of their communities, and they may want, possibly through their representative organizations, to assess the resources of their area to see what portion of the housing needs of the locality can be filled in the course of the next year and the years that follow. Taking stock of capacity and setting it against requirements will indicate how much can really be done with the existing facilities. In a number of cases such stock-taking will lead to expansion of capacity where the expansion is justified by the long-term building prospects in that locality—and perhaps surrounding areas. Suggestions for a procedure to arrive at local estimates of building material requirements are given in Appendix C.

11. *The Implementation of the Housing Target*

The attainment of a housing target of 50,000 units of desirable standards will provide living accommodation for about 50,000 families—comprising about 200,000 people—assuming there is no overcrowding. Such a program will provide a total of 289,000 rooms and housing space of some 782,000,000 cubic feet. These figures have to be raised by 20 per cent for each additional 10,000 units built (see Table 5). The average sized dwelling of desirable standards will comprise 5·8 rooms with a cubic foot content of 15,639.

Total construction expenditures involved in the erection of 50,000 housing units are likely to vary between $275 and $334 million (see Table 6 and Figure 3).

These expenditures are close to the expenditure for Canada's shipbuilding program (merchant marine and navy) during 1943, the year of peak production, when the program involved over a million tons of shipping. Their distribution is likely to be as follows:

(a) Expenditures for building materials, including transportation costs to the site, varying between $144 million and $175 million;

(b) Wage payments to on-site labour, including Unemployment Insurance contributions and payments to the Workmen's Compensation Fund, varying between $103 million and $125 million.[1]

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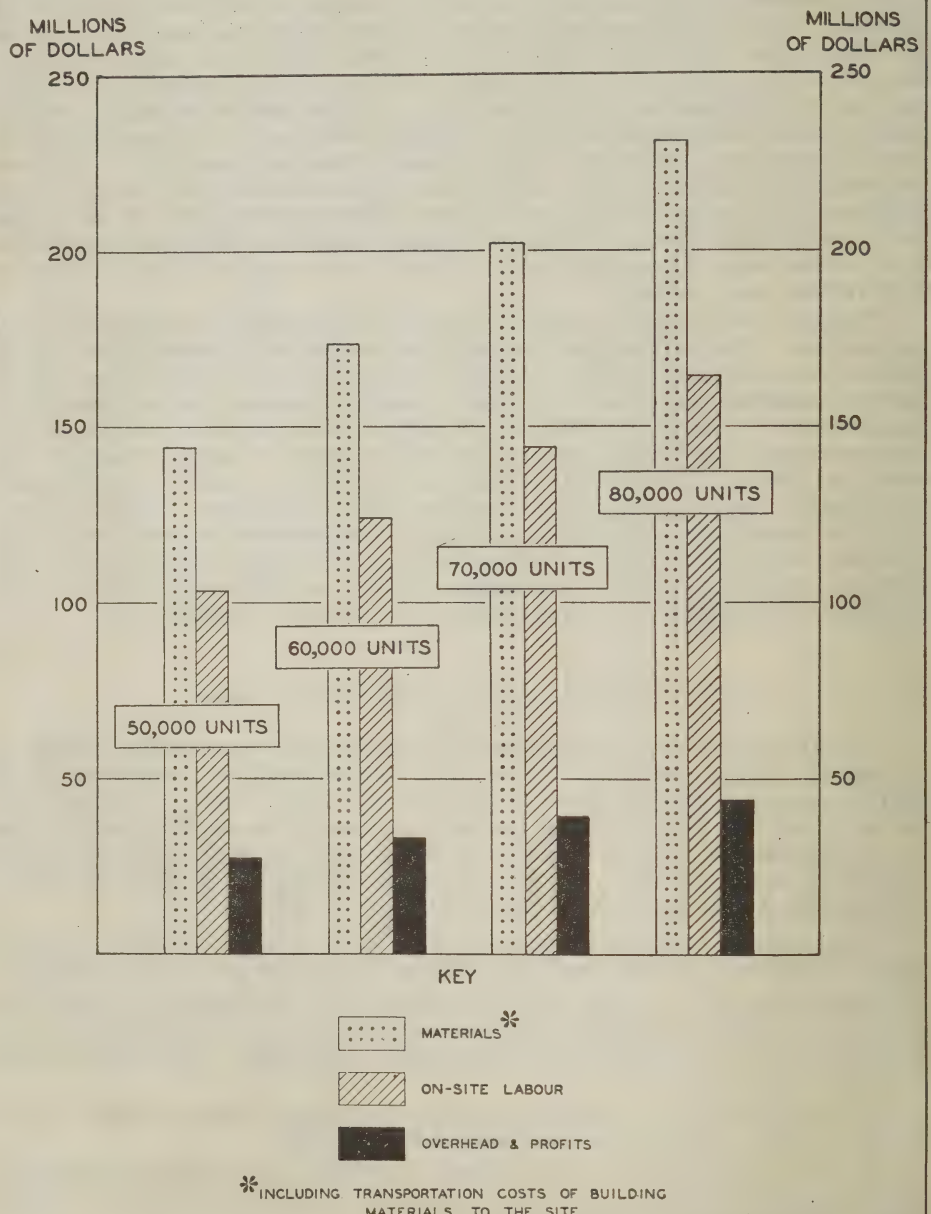
[1] It appears to be the practice among some house builders to include in labour costs payments for rental of machinery, e.g., excavating machinery, together with wage payment of a hired machine operator.

FIGURE 3 – CONSTRUCTION COSTS OF HOUSING TARGET
(ACTUAL STANDARDS)
MAJOR COMPONENTS



SOURCE OF DATA: SEE APPENDIX A.

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(c) Overhead and profits of builders and contractors varying between $28 million and $33 million.

But construction costs are only part of the cost involved in a housing program. Substantial real estate transactions have to take place to provide the building lots required.[1] On the basis of experience in administering the Dominion Housing Act, 1935, and the National Housing Act, 1938, it was found that the purchase of building sites, together with incidental costs connected with the acquisition of such sites, amounted, on an average, to about 10 per cent of total construction costs.[2] Accordingly, a housing target of 50,000 units might involve real estate transactions totalling between $27 million and $33 million.[3]

Professional men such as architects will be called upon to make an important contribution by assuring that new houses built are of a satisfactory architectural design. High standards of design are important not only for aesthetic reasons, but because they assure the consumer a better use value of the house. Architects' fees vary across the country and (for design and supervision) usually are within 5-7 per cent of the total construction cost of the individual project. Certain incidental expenses are incurred in building a new home, such as fees to lawyers for searching for titles, drawing up a contract, etc., and fees to surveyors who provide detailed information as to dimensions and location of the building lot. Thus other professional groups benefit by a large volume of new residential construction.

TABLE 5.—NUMBER OF ROOMS PROVIDED AND CUBIC FOOT CONTENT OF HOUSING TARGET, BY TYPES OF STRUCTURES

Type of structure	Percentage distribution		Housing target			
			50,000 units		60,000 units	
	Number of rooms	Cu. ft. content	Number of rooms	Cu. ft. content	Number of rooms	Cu. ft. content
Single house	82·14	81·83	237,000	639,900,000	284,400	767,880,000
Multiple unit house (2-6 units)	13·86	14·39	40,000	112,500,000	48,000	135,000,000
Row and apartment house (7 or more units)	2·44	2·30	7,024	17,966,250	8,428	21,559,500
Converted house	1·56	1·48	4,500	11,602,500	5,400	13,923,000
Total[1]	100·00	100·00	288,524	781,968,750	346,228	938,362,500
			70,000 units		80,000 units	
Single house	82·14	81·83	331,800	895,860,000	379,200	1,023,840,000
Multiple unit house (2-6 units)	13·86	14·39	56,000	157,500,000	64,000	180,000,000
Row and apartment house (7 or more units)	2·44	2·30	9,833	25,152,750	11,238	28,746,000
Converted house	1·56	1·48	6,300	16,243,500	7,200	18,564,000
Total[1]	100·00	100·00	403,933	1,094,756,250	461,638	1,251,150,000

Source: See Appendix A.

[1] The average dwelling unit consists of 5·8 rooms. The cubic foot content of the average dwelling is 15,639 cu. ft.

New housing construction has important effects on the financial status of municipalities. Where houses are built in areas already developed, new home owners and tenants will share in the costs of amortizing the existing investment

[1] Acquisition of building lots in relatively undeveloped or in newly settled districts in suburban areas and erection of residential dwellings thereon, together with the provision of public facilities, tend to increase land values in these districts, the increases accruing to the benefit of the owners of such real estate.

[2] Firestone, O. J., *The Labour Value of the Building Dollar*, National Housing Administration, Department of Finance, Ottawa, November, 1943, p. 24.

[3] These figures were rounded to the nearest million. They were computed by taking 10 per cent of the construction expenditures for 48,500 units, that is, the housing target minus 1,500 converted houses which do not require the acquisition of new building sites.

in public facilities and in their maintenance. As a result, the financial position of the municipalities is strengthened, enabling them either to reduce existing rates or to provide better and more extensive facilities and services to the citizens of the community. Where houses are built in new communities, existing public facilities have to be expanded or new ones installed. Expenditures will vary for individual projects and, although they might be spread over a number of years, substantial investment is involved in creating the necessary public facilities for urban development. New home builders pay for communal facilities and services in various ways, initially, often by cost-sharing payments, e.g., for connecting their homes with water, sewer and gas mains, or by fees for services, e.g., for building permits, and later through the payment of annual property taxes.

TABLE 6.—ESTIMATED CONSTRUCTION COSTS OF HOUSING TARGET, ON THE BASIS OF DESIRABLE AND ACTUAL STANDARDS, BY MAJOR COMPONENTS

(Thousands of Dollars)

Type of expenditure	Housing target			
	50,000 units	60,000 units	70,000 units	80,000 units
I. *Desirable Standards*—				
Materials[1]	175,198	210,238	245,277	280,317
On-site labour	125,142	150,170	175,199	200,227
Overhead and profits	33,371	40,045	46,719	53,394
Total	333,711	400,453	467,195	533,938
II. *Actual Standards*—				
Materials[1]	144,375	173,250	202,125	231,000
On-site labour	103,125	123,750	144,375	165,000
Overhead and profits	27,500	33,000	38,500	44,000
Total	275,000	330,000	385,000	440,000

Source: See Appendix A.

[1] Including transportation costs of building materials to the site.

A substantial part of the financing of new house building is done through lending institutions, mortgage, insurance and trust companies. In 1941, every second owner-occupied home in the twenty-seven cities in Canada with a population of 30,000 and over was mortgaged.[1] The proportion is likely to be even higher for rented premises. A large housing program will have the effect of using extensively the elaborate credit facilities established by lending institutions in Canada.

In conclusion, the execution of a large housing program will have a very direct bearing on the level of economic activity and the standard of living in Canada.[2] A wide range of people in all walks of life is affected because they are either badly in need of housing accommodation or because their livelihood depends on the building of a large number of houses. Thus the carrying out of a housing program is a matter of prime importance to almost all Canadians.

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[1] Housing Census 1941, Dominion Bureau of Statistics.

[2] The effects enumerated above are confined to what are usually described as "direct" effects. There are also "secondary" effects such as incomes in consumer goods industries generated through the spending of wage and salary payments and profits made in the construction industry and in the industries supplying building materials.

CHAPTER II. CONSTRUCTION COSTS, A FACTOR IN THE HOUSING PROGRAM

Besides physical bottlenecks and manpower shortages, high construction costs are considered a serious deterrent to a large housing program of a continuing nature. The level of construction costs affects greatly the decision to build or to postpone the building of new homes. To make a proper decision, informed judgment is needed.

What is meant by the statement that "construction costs are high"? "High" in relation to costs before the war? Or "high" as a result of lower output per man-hour or more wasteful construction methods in a post-war year as compared with those of a pre-war year? Or perhaps "high" as compared with what the same amount of money can buy in terms of other consumer goods (motor cars, radios, furniture, carpets) or services (education, tourist travel). These questions require an answer.

1. *Present Construction Costs Compared with Pre-War Costs*

The overwhelming portion of money spent for the construction of a new house goes into the purchase of building materials and wage payments to on-site workers. The proportions which these two major components of construction costs make up of the total vary somewhat (as will be explained later) over a period of time, as between regions and different localities, as between types of houses, and as between different sized projects. But unless entirely new construction techniques are applied, as e.g., in housing prefabrication, such changes in weight which do occur between costs of building materials and on-site labour costs are usually within a range of 5 to 10 per cent. Nevertheless, any rise or fall in prices of building materials or hourly wage rates paid to construction workers, and any increase or decrease in output per on-site man-hour will have a significant effect on the level of building costs.

The experience of the war years indicates that prices of building materials and wage rates of construction workers have risen, while efficiency of on-site operations has declined. The changes that have occurred are singled out for examination in the following text, with each element considered separately so that its relative importance can be appraised.

The price index of building materials stood at 102 in 1939 but was up to 144.8 in 1945, an increase of about 42 per cent. The index of wage rates of construction workers, which showed an annual average of 103.3 when the war started, had risen to 135·5 six years later, an increase of about 31 per cent (see Table V, Appendix B). These increases appear large on the surface but on examination it is found that they are more or less in line with increases in earnings and rises of prices and wages in most of the other sectors of economic activity in Canada. More serious, however, is the decline in efficiency which is discussed later on.

From 1939 to 1945, the output of the Canadian economy expressed in current dollars more than doubled. Gross National Product, the total value of goods and services produced in Canada, increased from $5·5 billion in 1939 to $11·4 billion in 1945. A substantial portion of the Gross National Product was made up of salaries, wages and supplementary labour income which, including military pay and allowances, amounted to $2·6 billion in 1939 and rose to $6·1 billion in 1945.[1]

During the six years of war, prices of wood, wooden products (including furniture) and paper rose by 52 per cent. During the same period, prices of

[1] *National Accounts, Income and Expenditure, 1938-1945*, op. cit., p. 6.

cattle, hogs, sheep, etc., meat and other animal products increased on an average by about 45 per cent. Prices of building materials with a rise of 42 per cent stayed somewhat behind. There were, of course, other commodities and products whose prices did not rise as much as the group just mentioned. Fibres, textiles and textile products rose by 31 per cent and iron and its products by only 19 per cent. The total food index, a composite of various commodities which generally make up the weekly menu of the average Canadian, showed an increase of 32 per cent. While it has to be acknowledged that prices of building materials have gone up, it appears that, as a result of price control, the increase has not been considerably out of line with the general rise in prices of most of the other commodities. The increase was only 5 per cent higher than the rise shown by the "All Commodities" Wholesale Index, based on 508 commodities, which had gone up 37 per cent between 1939 and 1945[1] (see Table 7 and Figure 4).

TABLE 7.—PERCENTAGE INCREASE OF HOURLY WAGE RATES FOR SELECTED GROUPS OF INDUSTRIES, OF WHOLESALE PRICES OF SELECTED COMMODITIES AND OF COSTS OF LIVING INDEX, CANADA, 1939-1945

Type of index	Percentage increase 1939-1945
I. *Wage Rates in Industry*[1]—	
Logging	61·4
Manufacturing	43·2
Mining	36·2
Construction	31·1
Transportation and communication	28·9
General average[2]	40·3
II. *Wholesale Prices of Commodities*—	
Wood and its products, and paper	51·5
Animals and their products	44·6
Building materials	41·9
Fibres, textiles and their products	31·1
Iron and its products	18·9
All commodities[3]	37·4
III. *Cost of Living Index*—	
Food	32·2
Total index	17·7

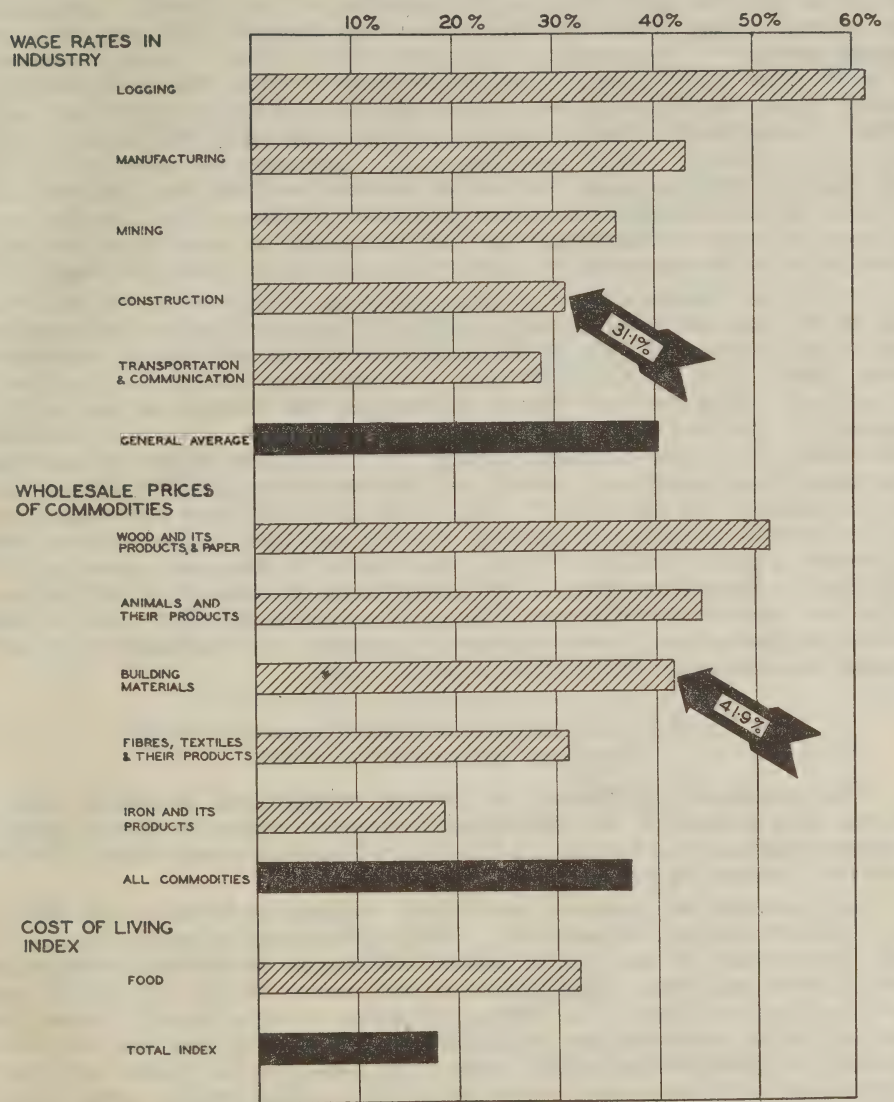
Source: See Appendix A.

[1] Preliminary.
[2] Weighted average based on the distribution of workers as given in the Dominion Census, 1941.
[3] Covering 508 commodities in 1945.

A similar situation becomes apparent in a comparison of increases in average annual hourly *wage rates* paid to employees of different industries. Wage rates paid to loggers increased by 61 per cent, to workers in manufacturing industries, by 43 per cent, and to miners, 36 per cent. Compared with these, lower increases were recorded for construction workers, 31 per cent, and for employees in the transportation and communication industries, 29 per cent. The general average of hourly wage rates paid to workers in industry increased by 40 per cent from 1939 to 1945 (see Table 7). However, *annual earnings* of construction workers increased considerably more than 31 per cent because of longer working hours and substantial curtailment of working time lost. Seasonal unemployment was cut down during the war years and so was the average time lost in changing jobs, since most of the time there were more openings in construction trades than men to fill them. In addition, the fairly common practice during the war years of paying skilled wages to semi-skilled and unskilled construction workers in order to obtain and hold them on the job also contributed to the increase in their average annual earnings.

[1] It bears emphasis that a system of price indices is not a sufficiently refined statistical instrument to take account of all changes in the quality of a commodity that may take place over a period of time. This is an important consideration, particularly during the war years when deterioration in quality of some commodities was unavoidable.

FIGURE 4 – INCREASES OF WAGE RATES, WHOLESALE PRICES & COST OF LIVING CANADA, 1939 – 1945



SOURCE OF DATA: SEE APPENDIX A

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The increase in residential building costs, due to a combination of changes in the two major elements, namely, prices of building materials and on-site labour costs, but excluding declines in efficiency of on-site operations, amounted to 37 per cent[1] from 1939 to 1945.

The difference in price and wage policy during World War I and World War II is quite marked. Prices of building materials rose by 50 per cent between 1913 and 1918 with a further increase of 65 per cent by the end of 1920—all in all, a total rise of 115 per cent from the beginning of World War I. Against this the increase during World War II—42 per cent between 1939 and 1945—was modest indeed.[2] Wage rates in the construction industry which, by the end of World War I, had risen by only 26 per cent over the 1913 level, rose very rapidly during the following two years to show a total increase of 81 per cent in 1920. During World War II, however, hourly wage rates had risen by about only 31 per cent by 1945[2] (see Figure 5). Increases in prices of building materials and wage rates of construction workers resulting from the conditions of World War II are likely to become permanent features of the Canadian price system and wage rate structure and are not likely to move in a downward direction unless accompanied by a general downswing of prices and wages.

In view of Canada's vigorous price and wage policy during the war years this country has succeeded, speaking in relative terms, in keeping prices and the cost of living down in spite of the pressure of strong inflationary tendencies. From 1939 to 1945, the Canadian Cost of Living Index recorded an increase of 18 per cent. This rise was slightly higher than the increase in that of New Zealand (15 per cent) but was lower than the increases in some of Canada's other Allies, the United Kingdom (29 per cent), the United States (30 per cent), Australia (23 per cent), and in such neutral countries as Sweden (42 per cent) and Switzerland (51 per cent).[3] Of course, Canada's price and wage policy will be affected by what is happening in other countries, but as matters stand at present, a general decline of prices and wage rates does not appear to be in sight for the immediate future. On the contrary, the present trend continues to be in an upward direction and is likely to remain so for some time to come. Such a long-term trend, however, does not preclude the possibility of an interruption in a downward direction for a limited time.

2. *The Effect on Construction Costs of Lower Output per Man-hour During the War Years*

The attainment of efficiency in housing construction, a difficult task in pre-war days because of the predominantly manual character of site assembly in house building, has become an even more formidable task during the war years for a number of reasons.

(a) Construction workers, particularly skilled tradesmen, are growing older without adequate replacement. This is illustrated by census figures. In 1921, for example, 64 per cent of persons working in construction occupations were 35 years and over. This proportion had risen to 66 per cent by 1931 and to 67 per cent in 1941. The latter percentage is substantially higher than that applicable to the working population as a whole. Of the total number of gainfully occupied persons in 1941, some 49 per cent were 35 years of age or over as compared with the above percentage of 67.[4] This gradual aging process with resulting declines in efficiency is mainly due to the fact that the number of

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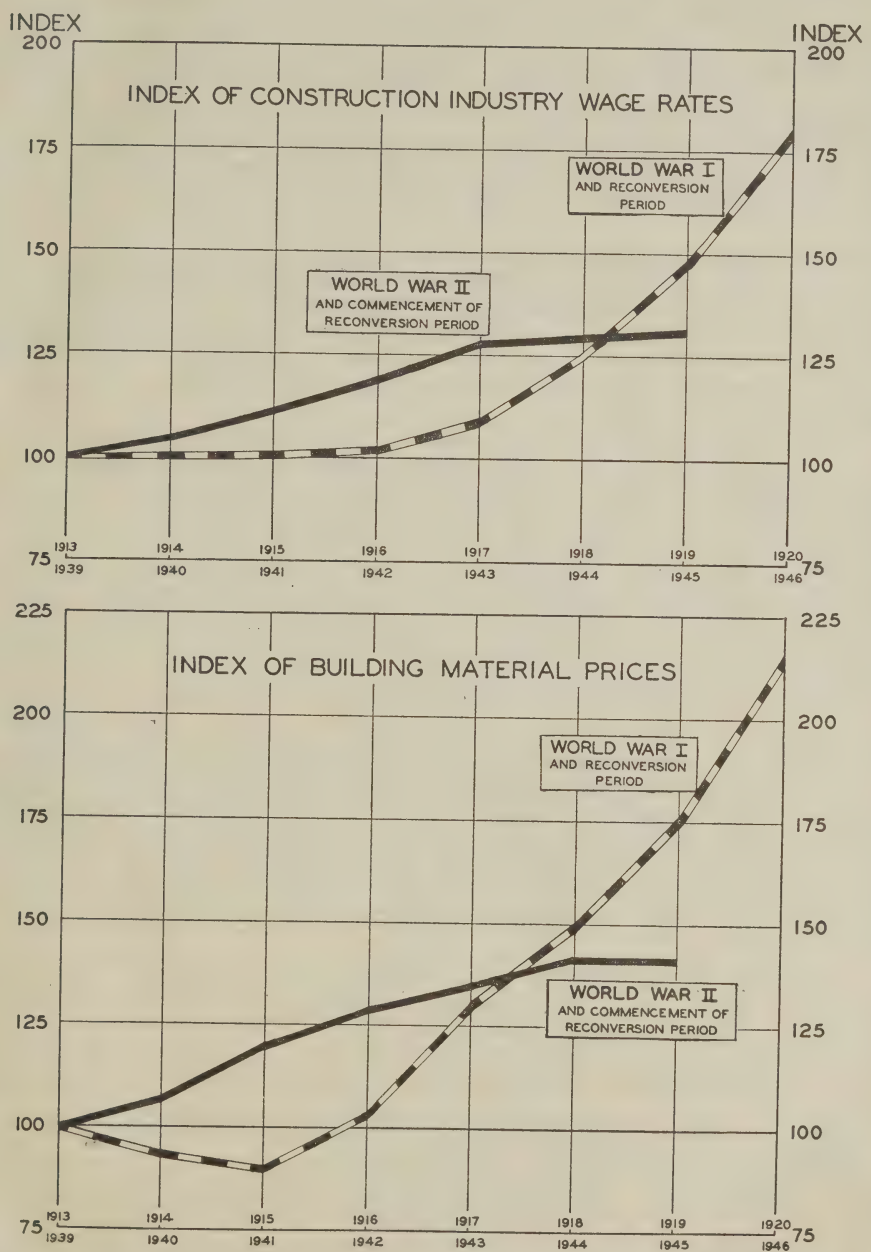
[1] The figure is arrived at by weighting the cost increases of the two components on the basis of 52·5 : 37·5. (See Note to Table 8, Appendix A).

[2] Trends of prices of building materials and hourly wage rates of construction workers during the inter-war period and World War II are shown in Table V, Appendix B.

[3] Figures on the rise of the Canadian Cost of Living Index from *Prices and Price Indexes, 1913-1943*, Dominion Bureau of Statistics, Ottawa, 1945, p. 58 and Monthly Bulletin on *Prices and Price Indexes*, April, 1946, p. 10; data for other countries from *International Labour Review*, International Labour Office, Montreal, March and April, 1946, pp. 295-300.

[4] Data from Dominion Census 1931 (Vol. VII, p. 9) and Dominion Census 1941 (Census Bulletin No. 0-3j). For 1941, adjustments were made to allow for construction workers in the armed forces.

FIGURE 5 — CONSTRUCTION COSTS DURING TWO WORLD WARS AND RECONVERSION PERIODS



SOURCE OF DATA: SEE APPENDIX A.

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younger men being trained in construction trades has, with a few exceptions, been consistently small in the past and hence insufficient to provide a replacement for the older men leaving work. The effect which depressed economic conditions had on the training of construction craftsmen is perhaps best illustrated by the experiences of the administration of the Ontario Apprenticeship Act, 1927. While 1,070 apprentices registered in construction trades in 1929, this number dropped to 22 in 1934, remaining consistently below 200 annual registrations during the 'thirties.[1]

(b) Large-scale construction projects for military and war production purposes kept a substantial portion of the construction industry extremely busy during the first few war years. These projects attracted the best craftsmen available. Others found even better paying jobs in war industry working as mechanics instead of as construction tradesmen. Still others joined the armed forces. As a result of these shifts, a gap was left in the labour force regularly employed in house building. This gap was partly filled by unskilled or semi-skilled men, causing a dilution of the skilled labour force with a resulting decline in efficiency.

(c) As the war proceeded, material shortages grew more serious. Consequently, operations on the building site were frequently held up by delays caused by certain building materials either not being available at all or arriving several days later than scheduled. As a result, workmen were held up and could not finish their assignments. They had to be paid for the time they spent waiting around on the job[2] and all this contributed to raising the cost of housing construction during wartime.

The reasons for declining efficiency in construction operations which had become apparent during the war years still existed at the conclusion of the war and are likely to remain in existence during the reconversion period. But an improvement of the situation is in sight with a step-up in the apprenticeship training program, the retraining and upgrading of ex-servicemen desirous of taking up a construction occupation, the shift to house building of construction workers from war industries and the armed forces, and some increase in the supply of building materials. As these improvements will make themselves felt, inefficiencies which are of a temporary nature and are the result of extraordinary conditions arising out of the war are likely to disappear in the next few years. This should be particularly true in cases where large-scale housing developments—a tendency in this direction can be clearly noted—would, through better organization, contribute to an increase of output per on-site construction man-hour.

Experience shows that inefficiencies resulting from the special circumstances of the war were negligible in cases where the builder employed regular construction crews and succeeded in lining up in advance a great deal of the building material required. However, practices of this sort were not very common and in most cases the factors enumerated above resulted in a decline of output per man-hour, sufficient to raise construction costs by an *additional* 10 to 25 per cent.[3]

Increases of construction costs resulting from higher building material prices and higher hourly wage rates of construction workers were of the order of some 37 per cent for the period 1939 to 1945. To this increase has to be added an allowance for the "inefficiency" factor so that the total increase of building costs over the war years varied between 47 and 62 per cent.[4] Preliminary data

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(1) Data by courtesy of Apprenticeship Branch of the Department of Labour, Province of Ontario.

(2) The practice of payment for "waiting around on the job" was adopted by contractors not wishing to lose their men through non-payment for inactivity.

(3) In cases where marginal builders were employed, the additional increment of building costs reached even higher proportions than the range indicated above. It should be noted that efficiency among house builders varies greatly with the organizational ability of the entrepreneur. While some experienced general contracting firms may use efficient methods, a great number of builders do not possess the advantages which some large construction organizations enjoy. While in some instances, individual small house builders will make up for this through effective personal supervision, the situation is aggravated by the entry of marginal builders into the construction field in times of prosperity, when, for a limited period of time, the market can bear the high operating costs of inefficient builders.

(4) The above percentage increases do not reflect any further charges which some speculative builders might have added to the sales price of a new house, beyond what was considered a reasonable profit margin before the war.

indicate that building costs have risen further since 1945. This further increase conforms to the pattern of other developments on the price and wage front during the first half of 1946. It bears emphasis, therefore, that the increase in construction costs due to reduced efficiency is the major element for bringing building costs out of line with current earnings and prices of other consumer commodities. However, as efficiency in the building industry increases and returns at least to pre-war levels, some reduction in building costs can be expected. Of course, such benefits might be offset by a further rise in prices of building materials and in wage rates paid to construction workers.

3. *Housing and Other Goods and Services Competing for the Consumer Dollar*

The construction of a house involves the assembly of a great number of parts requiring several thousand manual operations. The assembly takes place in most cases on an individual unit basis. Compared with the building of a house, the efficiency in producing other consumer goods, durable and non-durable, is much greater for a number of reasons:

(a) Most other consumer goods are mass-produced, while most houses are constructed as single units. The classical example, frequently referred to, is the mass-produced motor car put together on an assembly line, as compared with the made-to-measure job of fitting individual pieces together when building a house.[1]

(b) Most other consumer goods are manufactured in factories not affected by seasonal factors while housing construction, being carried on in the open air, can be delayed by inclement weather, resulting in higher cost of construction.

(c) Since many houses are produced in single units they do not enjoy the advantages of bulk purchasing, an important cost-reducing factor in the production of such commodities as motor cars, furniture, refrigerators, radios, etc.

(d) In the production of most other consumer goods, a high degree of mechanization is applied, while a house is assembled on the site by hand with the use of little up-to-date machinery. Further, not only is assembly by hand but the pieces to be assembled are hand-cut in large part, and each piece may be worked over by different tradesmen. This requires a multitude of operations which so far have resisted most attempts of proper co-ordination and adequate simplification.

But in spite of the fact that house building is organized on a less efficient basis than other consumer goods industries, houses are being built continuously, both for ownership and rental, though their number varies considerably over a period of time. Obviously, shelter is a basic need for living and there are physical limitations to the number of families and persons that can live in a house. However, where minimum housing needs are met, consumer preferences might tend in some instances toward other consumer goods rather than improvement of housing conditions. For example, a family of four living in a small downtown apartment might, with the improvement of the earning situation of the family head, have a choice of either acquiring a larger and better home in a suburb or of continuing to live in the apartment and purchasing a motor car. In one case the family will decide on improving its living conditions and buy a new home. In the other, the family will forgo the advantages of better housing accommodation and will prefer the convenience it can derive from the possession of a car, to a more comfortable home. In this case, the belief that a motor car provides a greater use value for the money spent than the acquisition of a house would not be without impact on the choice of the consumer. The consumer will also be influenced by appropriate sales and advertising campaigns and the social habits of his friends and other families in his community.

[1] Reference is made here to the erection of the individual unit of traditional design. Prefabrication methods and erection of large housing projects are likely to introduce certain cost-saving elements but so far these have remained a minor factor in a national housing program.

It appears that, even with a high level of employment and earnings, the acquisition of a new home will always be competing with other consumer goods for its share of the consumer dollar. This factor is of great significance for the building industry. If it does not succeed in keeping unit costs low its business will decline because of the strong competition of other consumer goods industries working under more favourable conditions. The conclusion is self-evident. The greater the increase in the efficiency of the house-building industry and the narrower the present gap between housing construction and production of other consumer goods, the better are the prospects for a larger share of the consumer dollar going into housing than hitherto.

4. *Composition of Construction Costs*

The purchase price of a newly constructed house consists of a number of components of which construction costs are the largest single item. Others include acquisition of a building site, payments for professional services (such as those of architects, lawyers, and surveyors), installation costs for services by public utilities, fees and other charges for services by municipal authorities.

But construction costs[1] themselves are a composite item falling into several major components which, in this study, are separated into three groups as shown on the left side of Schedule A. However, this classification is very broad and includes some 10 groups of items listed on the right side of the Schedule.[2]

SCHEDULE A.—GROUPING OF MAJOR COMPONENTS OF CONSTRUCTION COSTS

Classification by three major components[1]	Classification by ten major groups of items
1. Building material costs (1 to 3)	1. Purchase of building materials. 2. Transportation costs of building materials to the site. 3. Storage of building materials.
2. Labour costs (4 to 7)	4. Salary payments to supervisory staff (e.g., engineers in the field and superintendents). 5. Wage payments to on-site labour force (foremen, construction tradesmen, semi-skilled and unskilled construction labour and other workers, e.g., watchmen). 6. Hire of machine operators.[2] 7. Social security payments (unemployment insurance and workmen's compensation).
3. Overhead and profits (8 to 10)	8. Job overhead (e.g., depreciation of owned machinery, fuel and lubricants, plant repairs, perishable tools, erection of job shed, fire insurance, and temporary light and heat). 9. Office overhead (e.g., salary of engineers and draftsmen, rentals and telephone). 10. Remuneration and profits of builder.

Source: See Appendix A.

(1) The figures following each major component refer to the corresponding items on the right side of the Schedule.
(2) Rental of machinery should be included under job overhead (item 8) but it is frequently included in the labour costs because payments are lumped together with remuneration of machine operators.

On the basis of the results of a survey, the following overall ratios were taken as representative of the major components of construction costs of total new housing construction in Canada: building material costs—52·5 per cent, labour costs—37·5 per cent, overhead and profits—10 per cent.[3] However, these ratios are only applicable to national averages and will vary somewhat in individual cases for a number of reasons:

(1) In practice, construction costs are interpreted differently by different groups of builders. Small house builders frequently include cost of land in their total construction cost estimates. General contractors, however, do not follow this practice as a rule.
(2) Of course, this particular classification could be presented in a much more detailed way, but only groups of items are listed, with a few examples as an illustration.
(3) For sources of survey, see Note to Table 8, Appendix A.

(a) The weight of the different components will vary over a period of time. Labour costs may make up a somewhat larger proportion of total costs. For example, the special conditions in the house-building industry arising out of the war, referred to previously, have resulted in a decline in efficiency due to a dilution of the labour force and delays in construction as a result of shortages of building materials. In individual cases this might result in the weight of labour costs becoming larger than that of outlay on materials. Overhead and profits of builders might rise from 10 per cent to 15 or even 20 per cent of total costs in the case of a large demand for houses not being matched by an adequate supply. This will be particularly true in cases where houses are not built on contract but where large operators who act as builders and developers add an additional charge to the price of the house for the risks they take.

(b) Regional and local variations in prices of building materials and wage rates of labour will affect the composition of construction costs. In some areas building materials are cheaper than in others, e.g., lumber in British Columbia, while the opposite might be true for hourly wage rates paid to construction workers. In other sections of the country, building materials might be somewhat more expensive, with hourly wage rates being lower, as is the case in the Province of Quebec. Further, the efficiency of construction workers will vary depending on the age of the man, his skill, natural ability and diligence. For example, some bricklayers used to lay as many as 800 bricks a day while to-day, some will not lay more than 300. Output per man-hour will also vary depending on building practices in different localities. Men employed as sub-contractors are likely to turn out more per hour of work than tradesmen who are paid by the hour, independently of their output.

(c) The composition of building costs will vary somewhat for different types of housing units. The construction of a solid brick house will require more manual labour than a wood frame house with wood clapboard because it takes longer to lay bricks than to fasten boards to a wooden frame and to cover them with clapboards. A solid masonry house of masonry blocks with part stone facing and part stucco will require even more hand labour on the site than a solid brick house because of the need to dress stones so as to make them fit together. However, variations in the relative proportions on this count as between cost of building materials and on-site labour will only rarely exceed a range of 5 to 10 per cent.

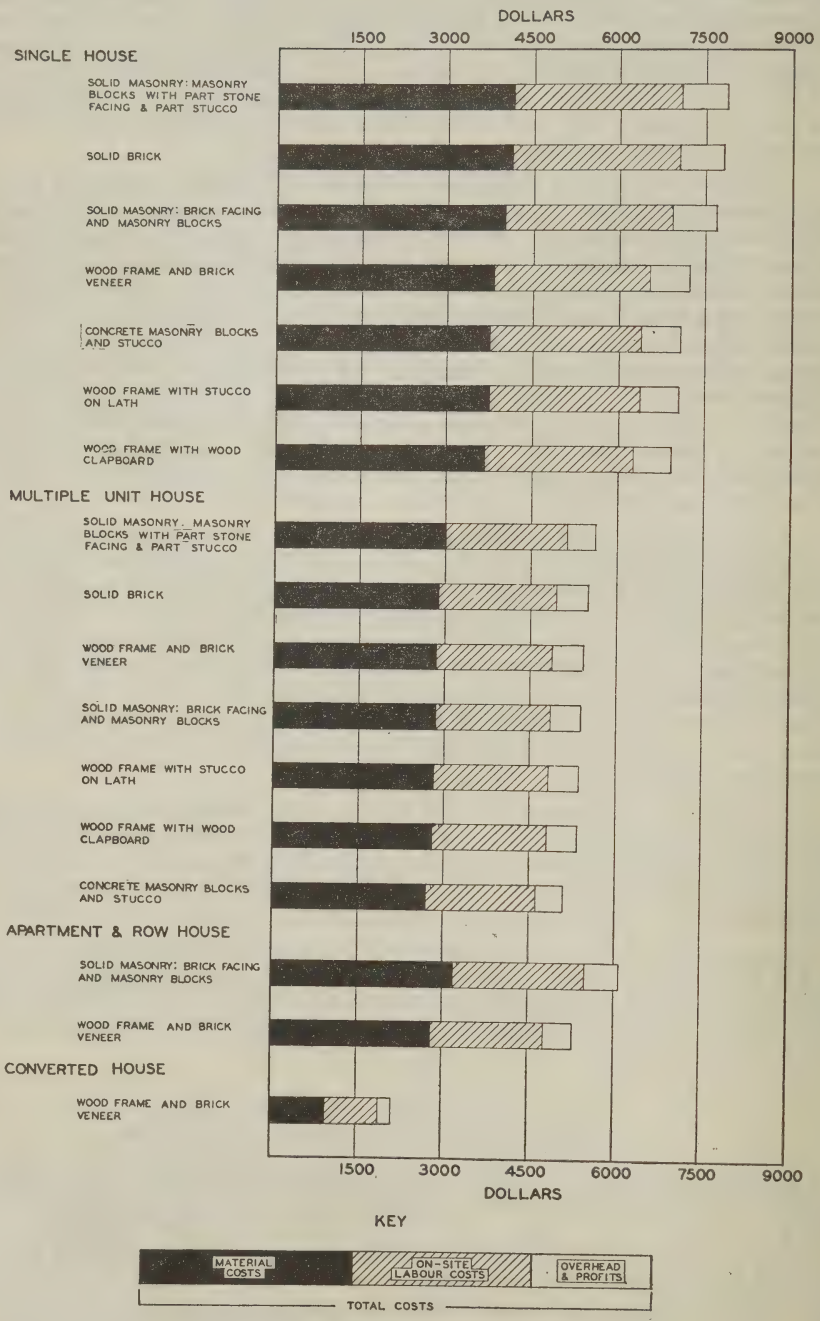
(d) Large-scale housing developments might bring savings in building material costs (through bulk purchases) and in labour costs (as a result of better organization of the on-site labour force). But such savings on a unit basis will vary for the different projects. They might be relatively more important in the building material field in some cases and in on-site labour costs in others.

These qualifications should be borne in mind when considering construction costs for the different types of housing units discussed in the section below. It bears emphasis that the figures quoted below relate to construction costs as defined in Schedule A and do not include non-construction items such as outlay for land acquisition, fees, services, bank charges, etc.

5. *Cost Variations for Different Housing Units*

Construction costs for single houses, if measured on a unit basis are, as to be expected, higher than those of multiple houses, row and apartment houses (see Table 8 and Figure 6). But on examination it will be found that single houses provide more living space and would therefore be more expensive on this account alone quite apart from the fact that they do not enjoy such cost-saving advantages as are found in multiple units where one basement and one roof serve several units. The distinction as between total costs of different types of housing units

FIGURE 6–COMPONENTS OF CONSTRUCTION COSTS OF ONE HOUSING UNIT BY TYPES OF STRUCTURES AND BUILDING MATERIALS USED



SOURCE OF DATA: SEE APPENDIX A.

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appears in a different light when measured in terms of cost per room or per cubic foot of living space.

Construction costs per cubic foot for single houses are estimated to vary between 43c. and 49c. as compared with 34c. and 38c. for multiple houses and row houses and 60c. for apartment houses. Costs of 27c. per cubic foot of living space created through conversion of existing houses are lowest and are, therefore, the cheapest way of providing additional housing accommodation (see Table 9). Since housing conversion, however, depends on the existence of large buildings most of which were constructed at the turn of this century or before, the extent of such a program is definitely limited.

Perhaps the most outstanding feature of these cost per cubic foot figures is the fact that they dispel the belief that construction costs per unit in large apartment houses are much lower than those incurred in the building of single houses. It is true that on a unit basis construction costs of apartments are some 22 per cent lower than those of single houses but on a cubic foot basis the position is just the opposite with apartment costs being 25 per cent higher than those of single houses. This situation is explained by the fact that large apartment houses are built of fireproof construction with heavier structural elements and more elaborate foundations. The installation of elevators, the nature of the heating system, and the addition of a garage in the basement further add to the cost.

In new housing construction (i.e., excluding housing conversion) units in multiple and row houses show the lowest costs, both in terms of unit price or costs per room or cubic foot. Costs of these houses are on an average some 20 per cent below those of single units.

Taking account of building materials as the determining criteria, single houses built of wood frame with wood clapboard and wood frame with stucco on lath are cheapest for the single house group (43c. per cubic foot) with solid masonry houses of masonry blocks with part stone facing and part stucco being the most expensive (49c. per cubic foot). Cost differentials between a solid brick house (Type F) and a wood frame house with wood clapboard (Type A) do not appear to be as large in 1946 as they were before the war. There are several reasons. Because only a few brick houses were built during the war years, the productive capacity of brick yards and the demand for bricks were lower than they were in the 'twenties. Pressure on the price ceiling of bricks was therefore much less pronounced than in the field of lumber supplies where external and internal demands, both for war and civilian purposes, reached new peaks in Canada's history.[1] As a result, prices of lumber and lumber products increased more rapidly than those of brick and other clay products as is illustrated by the following figures. The index of wholesale prices of lumber stood at 105·4 in 1939 but increased to 179·9 in 1945, a rise of 70·7 per cent. Against this the index of wholesale prices of clay products showed an increase of only 21·3 per cent from 98·5 in 1939 to 119·5 in 1945.[2]

Due to shortages of bricks and skilled bricklayers during the war years—a trade marked particularly by a concentration of craftsmen in the older age brackets, with only few younger men possessing sufficient skills—the number of solid brick houses built has in the past few years been comparatively small with more houses being built of concrete masonry blocks and stucco. This situation is likely to continue until the supply of bricks and men to lay them becomes more plentiful.

In conclusion, the problem of housing construction costs is not only tied in with a rise in prices of building materials, in wage rates paid to labour in the construction industry, and in remuneration of builders and contractors, but

[1] Output of lumber (sawn) in Canada reached a peak during the war years when in 1941 production amounted to 4,941 million feet board measure. This compared with previous peaks of 4,918 million feet board measure in 1911, and 4,741 million feet board measure in 1929. (Data by courtesy of Forestry Branch, Dominion Bureau of Statistics.)
[2] Data by courtesy of Prices Branch, Dominion Bureau of Statistics. Base of index: 1935-1939 = 100.

perhaps even more so with the comparatively low degree of efficiency in terms of output per man-hour on the site and the relatively large number of on-site man-hours required to manually perform a task which so far has withstood, to a large degree, any application of the process of mechanization. Prefabrication and site assembly techniques which have made some strides during the war years, particularly in connection with the construction of temporary housing for war workers, have so far not been perfected enough to allow the conclusion that they will bring about substantial overall increases in efficiency in a comparatively short period. The trend appears rather to be one of gradual improvement of organizing on-site work, use of some power machinery on the site, large-scale building developments with their cost-saving possibilities, simplification of design (desirable only if it does not sacrifice aesthetic and use value of the house) and standardization of parts and equipment. These factors, added to whatever advances are made in prefabrication and site assembly techniques of factory pre-cut sections and parts, hold promise for some increase in efficiency in the housing field. Progress of this sort, however, cannot be achieved without an all-out effort on the part of the multitude of individuals, companies, institutions and public agencies which share in the responsibility of providing high quality housing for Canadians.

TABLE 8.—COMPONENTS OF CONSTRUCTION COSTS OF ONE HOUSING UNIT, BY TYPES OF STRUCTURES AND KINDS OF BUILDING MATERIALS USED

Code	Type of structure and kind of building material used	Material costs	On-site labour costs	Overhead and profits	Total costs
	I. *Single house*—	$	$	$	$
A	Wood frame with wood clapboard	3,663	2,616	697	6,976
B	Wood frame and brick veneer	3,816	2,726	727	7,269
C	Wood frame with stucco on lath	3,691	2,636	703	7,030
D	Concrete masonry blocks and stucco	3,740	2,671	712	7,123
E	Solid masonry: brick facing and masonry blocks	4,065	2,904	774	7,743
F	Solid brick	4,105	2,932	782	7,819
G	Solid masonry: masonry blocks with part stone facing and part stucco	4,187	2,991	798	7,976
	II. *Multiple unit house*—				
A	Wood frame with wood clapboard	2,796	1,997	533	5,326
B	Wood frame and brick veneer	2,866	2,047	546	5,459
C	Wood frame with stucco on lath	2,833	2,023	540	5,396
D	Concrete masonry blocks and stucco	2,703	1,930	515	5,148
E	Solid masonry: brick facing and masonry blocks	2,855	2,039	544	5,438
F	Solid brick	2,886	2,061	550	5,497
G	Solid masonry: masonry blocks with part stone facing and part stucco	2,977	2,127	567	5,671
	III. *Row and apartment house*—				
B	Wood frame and brick veneer	2,790	1,993	531	5,314
E	Solid masonry: brick facing and masonry blocks	3,178	2,270	605	6,053
	IV. *Converted house*—				
B	Wood frame and brick veneer	972	938	212	2,122
—	Weighted average[1]	3,504	2,503	667	6,674

Source: See Appendix A.

[1] Weight based on the distribution of housing target as shown in Table I, Appendix B.

TABLE 9.—CONSTRUCTION COSTS PER ROOM AND CUBIC FOOT, BY TYPES OF STRUCTURES AND KINDS OF BUILDING MATERIALS USED

Code	Type of structure and kind of building material used	Cost per unit	Rooms per unit	Cubic feet per unit	Construction costs per	
					Room	Cubic foot
		$	No.	No.	$	$
	I. *Single house*—					
A	Wood frame with wood clapboard	6,976	6	16,200	1,163	·43
B	Wood frame and brick veneer	7,269	6	16,200	1,212	·45
C	Wood frame with stucco on lath	7,030	6	16,200	1,171	·43
D	Concrete masonry blocks and stucco	7,123	6	16,200	1,187	·44
E	Solid masonry: brick facing and masonry blocks	7,743	6	16,200	1,291	·48
F	Solid brick	7,819	6	16,200	1,303	·48
G	Solid masonry: masonry blocks with part stone facing and part stucco	7,976	6	16,200	1,329	·49
	II. *Multiple unit house*—					
A	Wood frame with wood clapboard	5,326	5⅓	15,000	999	·36
B	Wood frame and brick veneer	5,459	5⅓	15,000	1,024	·36
C	Wood frame with stucco on lath	5,396	5⅓	15,000	1,012	·36
D	Concrete masonry blocks and stucco	5,148	5⅓	15,000	966	·34
E	Solid masonry: brick facing and masonry blocks	5,438	5⅓	15,000	1,020	·36
F	Solid brick	5,497	5⅓	15,000	1,031	·37
G	Solid masonry: masonry blocks with part stone facing and part stucco	5,671	5⅓	15,000	1,064	·38
	III. *Row and apartment house*—					
B	Wood frame and brick veneer	5,314	6	15,000	886	·35
E	Solid masonry: brick facing and masonry blocks	6,053	3⅞	10,125	1,562	·60
	IV. *Converted house*—					
B	Wood frame and brick veneer	2,122	3	7,735	707	·27
—	Weighted average [1]	6,674	5·8	15,639	1,151	·43

Source: See Appendix A.

[1] Weight based on the distribution of housing target as shown in Table I, Appendix B.

CHAPTER III. THE MEN WHO DO THE JOB

The employment *directly* attributable to a housing program falls into two categories. One group comprises the people who plan a house such as architects, and those who provide services essential, in most cases, to house building in its pre-construction stages, e.g., real estate dealers, lending institutions, lawyers and surveyors. It includes also contractors, builders and developers who organize and supervise the construction of a house, and finally actual on-site workers such as foremen, building craftsmen, semi-skilled and unskilled construction workers. The other group consists of those who produce, store, sell and transport the building materials required for housing construction. This group is wide and varied and includes people in all walks of life ranging from the raw material producers in Canada's mines and forests to large manufacturing concerns, or from a wholesaler in a large city to a hardware store keeper and station agent in a small community.

1. *On-site and Off-site Employment*

Estimates of manpower requirements for a housing target varying between 50,000 and 80,000 units in dimensions are given below, in terms of *(a) on-site employment*, that is, employment of the men who actually build the house on the site, and *(b) off-site employment*, that is, employment of the working force engaged in producing and distributing building materials and transporting them to the site.[1]

The bulk of the on-site labour force is made up of building craftsmen of various trades. They include brick and tile layers, stone masons, carpenters, cement and concrete finishers, electricians, wiremen, painters, decorators, glaziers, plumbers, steam and gas fitters, roofers, slaters and sheet metal workers. A study of the experience gained in administering National Housing legislation indicated that about 70 per cent of the on-site man-hours provided, comprised work done by skilled tradesmen.[2] The remainder of the on-site labour force is mainly made up of mechanics such as operators of excavating machinery, labourers who dig the earth, mix cement, carry building materials and do many other manual chores, together with supplementary personnel not actually engaged in construction work, such as supervisors and watchmen.

This great variety of construction craftsmen and other persons employed on the site in building a house would find work to the extent of some 132 million man-hours, if 50,000 housing units of a desirable standard are built. Or, in terms of years of work, some 75,000 people would be employed on the site for what is usually considered a full construction year.[3] Even more people will find employment off the site in the industries supplying building materials and transportation services. The same program would provide additional employment of the latter type amounting to 174 million man-hours, equivalent to 87,000 jobs for one year. Thus, a housing target of 50,000 units would provide total employment (on the site and off the site) for 162,000 persons for one year involving some 306 million man-hours. Each additional 10,000 housing units will mean new jobs for some 32,000 people.

The above figures relate to a housing target of desirable standards and are, therefore, likely to be about 20 per cent higher than the employment provided by an actual standard housing target (see Table 10 and Figure 7). It is apparent that the level of employment provided by a housing program of 50,000 units which employs between 134,000 and 162,000 men is comparatively high due

[1] Not included in the estimates are the man-hours spent by professional personnel and entrepreneurs connected with house building.
[2] *Man-hours and Wage Rates in House Building, 1935-1943*, Supplementary Memorandum No. 1, National Housing Administration, Ottawa, May, 1944.
[3] Allowance has been made for seasonal unemployment (see Note to Table 10, Appendix A).

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mainly to the substantial proportion of hand labour involved in on-site building work. The importance to the economy of this large volume of employment provided by house building is perhaps best illustrated by the fact that it approximates the total number of persons working on the combined production of aircraft, guns, shells, bombs and explosives at the peak of war employment in the second half of 1943. Thus, house building with its varied ramifications on the economy as a whole, can, if maintained at a high level, become a significant source of employment and income for Canadians. Of course, there will be difficulties because the skills required cannot always be matched by the type of workmen available, but there is little that cannot be remedied in the long run by an appropriate and effective training program.

On-site employment on a program of 50,000 units of a desirable standard will absorb about 30 per cent of the total working labour force presently available to the construction industry.[1] This proportion in the employment field is in line with the experiences of high residential building activity in the past. When house building activity was at its peak in the late 'twenties it is estimated that new urban house construction made up some 30 per cent of total construction.[2]

TABLE 10.—ESTIMATED ON-SITE AND OFF-SITE MANPOWER REQUIREMENTS OF HOUSING TARGET ON THE BASIS OF DESIRABLE AND ACTUAL STANDARDS

Type of employment	Housing target							
	50,000 units		60,000 units		70,000 units		80,000 units	
	man-hours 000	man-years[1] 000	man-hours 000	man-years[1] 000	man-hours 000	man-years[1] 000	man-hours 000	man-years[1] 000
I. *Desirable Standards*—								
On-site	132,112	75	158,534	90	184,957	105	211,379	120
Off-site	173,880	87	208,656	104	243,432	122	278,208	139
Total	305,992	162	367,190	194	428,389	227	489,587	259
II. *Actual Standards*—								
On-site	108,869	62	130,643	75	152,416	87	174,191	99
Off-site	143,289	72	171,947	86	200,605	101	229,262	115
Total	252,158	134	302,590	161	353,021	188	403,453	214

Source: See Appendix A.

[1] To allow for seasonal factors the average on-site man-year was taken to comprise 1,760 man-hours or 40 working weeks of 44 hours each. The average off-site man-year was taken to comprise 2,000 man-hours or 45·4 working weeks of 44 hours each.

2. *Variations of Employment for Different Housing Units*

The employment content of residential construction varies as between different types of dwelling units. This variation is partly expressed in the different costs per housing unit discussed in more detail in the previous chapter.

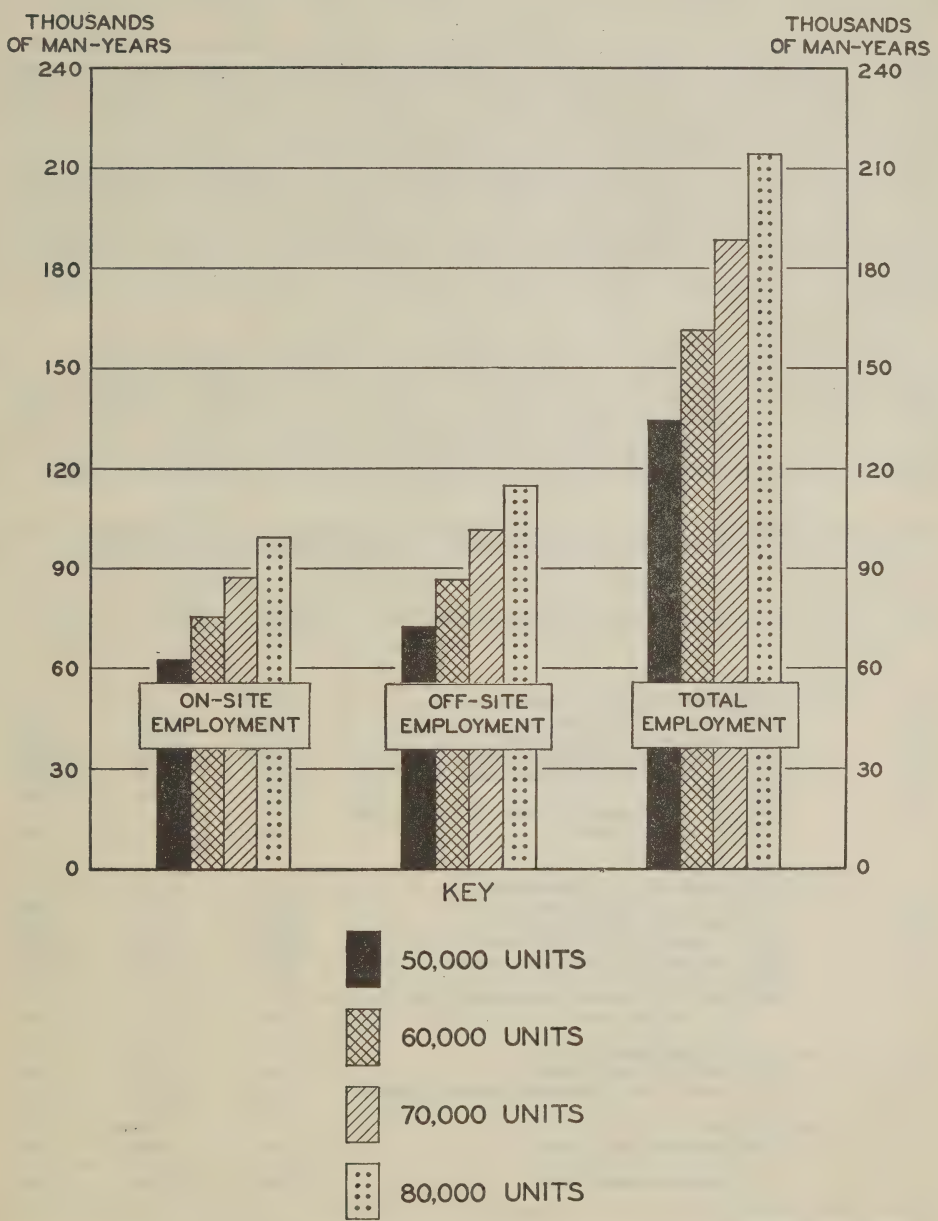
Cost variations, however, are only one way of indicating the economic significance of different consumer goods produced. They indicate the market value of the goods but they do not necessarily indicate the human effort involved in creating these commodities. A house of a given value, erected by an inexperienced builder using a great number of unskilled and low paid workers would require a larger number of man-hours than the same house built by an expert builder using well trained and highly paid building crews. Yet, there may be no variation in the ultimate price of the house paid by the consumer because

[1] The 1941 Population Census indicated a total labour force in the construction industry of 236,346 persons, to which has to be added some 15,200 men in the armed forces who formerly worked in the construction industry and most of whom are likely to return to their former occupations.

[2] For 1928 the proportion was 32 per cent and for 1929 about 28 per cent (*Public Investment and Capital Formation*, Dominion-Provincial Conference on Reconstruction, Ottawa, August, 1945, p. 38).

FIGURE 7 – TOTAL EMPLOYMENT PROVIDED BY HOUSING TARGET

(ACTUAL STANDARDS)



SOURCE OF DATA: SEE APPENDIX A.

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the high wages paid to construction workers and the larger remuneration to the successful builder would be offset by higher output per man-hour and better managerial effort. Even if building costs are not increased by a low output per man-hour and inefficiency of management—it has been noted that inefficiency did increase building costs during the war years—such a situation is undesirable because it entails a waste of human effort that could be directed to much better use elsewhere.

To properly appraise the economic significance of housing construction, it is necessary to gauge not only costs, but also the manpower requirements involved.

The average dwelling unit of the housing target of desirable standards is estimated to provide employment for 2,642 man-hours on the site, and 3,449 man-hours off the site, or a total of 6,091 man-hours. Taking 1,760 man-hours as the average working year for the construction worker, the building of one housing unit will provide 1·5 man-years of work on the site. The average working year in factories, commercial businesses and services is usually taken as 2,000 man-hours. On this basis, 3,449 man-hours involved in the fabrication of building materials and their transportation to the site will provide about 1·7 man-years of off-site work. The construction of one housing unit, therefore, is likely to provide work for slightly more than three persons for what is usually considered a full working year.

The smallest amount of labor needed to complete one housing unit is for converted housing, which does not require more than 1,952 man-hours. As compared with this, the construction of a single house requires approximately three and one-half times as much effort, varying between 6,389 and 7,303 man-hours per unit. Comparing single with multiple housing units, the latter require between one-quarter and one-third fewer man-hours than the former (see Table 11).

TABLE 11.—ESTIMATED ON-SITE AND OFF-SITE EMPLOYMENT OF ONE HOUSING UNIT, BY TYPES OF STRUCTURES AND KINDS OF BUILDING MATERIALS USED

Code	Type of structure and kind of building material used	On-site man-hours	Off-site man-hours	Total man-hours
	I. *Single house*—			
A	Wood frame with wood clapboard	2,754	3,635	6,389
B	Wood frame and brick veneer	2,869	3,787	6,656
C	Wood frame with stucco on lath	2,775	3,663	6,438
D	Concrete masonry blocks and stucco	2,812	3,712	6,524
E	Solid masonry: brick facing and masonry blocks	3,057	4,035	7,092
F	Solid brick	3,086	4,074	7,160
G	Solid masonry: masonry blocks with part stone facing and part stucco	3,148	4,155	7,303
	II. *Multiple unit house*—			
A	Wood frame with wood clapboard	2,102	2,775	4,877
B	Wood frame and brick veneer	2,155	2,845	5,000
C	Wood frame with stucco on lath	2,129	2,810	4,939
D	Concrete masonry blocks and stucco	2,032	2,682	4,714
E	Solid masonry: brick facing and masonry blocks	2,146	2,833	4,979
F	Solid brick	2,169	2,863	5,032
G	Solid masonry: masonry blocks with part stone facing and part stucco	2,239	2,955	5,194
	III. *Row and apartment house*—			
B	Wood frame and brick veneer	2,098	2,769	4,867
E	Solid masonry: brick facing and masonry blocks	2,389	3,153	5,542
	IV. *Converted house*—			
B	Wood frame and brick veneer	987	965	1,952
—	Weighted average[a]	2,642	3,449	6,091

Source: See Appendix A.

[a] Weight based on the distribution of housing target as shown in Table I, Appendix B.

During the present transition period, when scarcity of labour and materials make economies necessary wherever possible, these findings indicate some of the possibilities in the field of house building, by making the maximum use of limited resources, through the conversion of as many large single houses as possible, and through the construction of more multiple housing units (apartment and row houses), where such projects fit the environment and the living habits of the people.

CHAPTER IV. VOLUME OF BUILDING MATERIALS REQUIRED

The demand for different kinds of building materials[1] for a housing target will depend on a great number of factors. Some of these can be anticipated with a reasonable degree of exactitude, others can be appraised qualitatively, with quantitative assessment, however, being difficult, while still others can be noted although little is known as to how they will influence the effective demand for building materials. The demand for plumbing equipment is an example of the first group since modern sanitary facilities have become an accepted standard in urban homes. Requirements for bricks is an example of the second group. Given a demand for a certain number of brick houses, the number of bricks required can be estimated. But the demand for bricks will not become effective unless there is an adequate number of bricklayers to lay the bricks and the number of bricks laid per man-hour is sufficiently high to make building on an economic basis possible. If the efficiency of bricklayers is very much out of line with that of other tradesmen, substitute materials employing different types of labour are likely to be used to an increasing extent. An example of the last mentioned group of factors is the influence which a large measure of prefabrication might have on the pattern of building material needs. If a substantial number of prefabricated houses, say, of aluminum, were erected, this would greatly increase the demand for aluminum but reduce the demand for lumber and other more common structural materials.

1. *Factors Determining Effective Demand*

In preparing estimates on building material requirements, account of all known factors was taken and allowance was made for imponderables where this was possible on the basis of available information. The factors which influence the composition of the aggregate demand for building materials and its size for a given housing target can be briefly summarized as follows:

(a) *Size and Composition of the Housing Target.* The larger the number of houses built, the greater the quantity of building materials needed. Small housing units will need less material than large ones. If more apartments are built than single houses, fewer units of certain types of equipment will be needed. If more cinder block and less brick construction is undertaken, this again will influence the volume of individual (and total) material requirements. Account was taken of these factors in determining the most common building patterns and applying them to a frequency distribution of the various types of houses currently being built across the country.[2]

(b) *Availability of Building Materials.* In ordinary times, when building material supplies are plentiful, availability of building materials is a minor factor in influencing the selection of the type of house to be built and consequently the kind of materials that will be used. But in times when shortages of certain construction materials are severe, particularly in lines where residential construction has to compete with substantial demand for the same kind of materials from other types of construction (mainly large developments involving industrial and commercial projects), availability of materials has a significant influence on the decision of the individual home owner or large developer as to the type of house or houses they are likely to build. Since there were already marked shortages of building materials during 1945, it was possible to consider the factor of availability of building materials in working out a building material pattern.

[1] Building materials are taken to include materials (lumber, cement, bricks, etc.), parts (doors, windows, etc.), equipment (stoves, furnaces, etc.) and installations (heating, plumbing, electrical fixtures, etc.).

[2] For details, see Chapter I.

This was done on the basis of past experience with due allowance for some increase in production likely to be forthcoming during 1946 and 1947.

(c) *Consumer Preference.* Availability of materials is a special factor affecting consumer preference in the transition period. But there are other factors of a more general character which have an impact on the choice of the consumer. Consumer preference is closely related to income levels as determined by economic opportunities. It is also affected by the composition of the population and its living habits (cost of living differences), individual taste and scale of aesthetic values. Local preference for certain types of structures and the degree of neighbourhood planning will also influence individual consumer's choice. Thus consumer preference becomes an important element in determining the selection of the type and size of structure, quality and method of construction and hence the kind of materials which will be used. Sufficient information was available for 1945 to gauge current patterns of consumer preference.

(d) *Possibility of Substitutions.* Assuming that a prospective home owner has chosen a house which he considers most suitable for his purposes, he may find that with regard to certain materials or equipment not in short supply, he may have the choice between one or another kind, or perhaps even among several kinds. No estimate of requirements of building materials for a given housing target can neglect to take account of the possibility of substitution—within the limitations of the availability of supply, of course. Thus, for example, wood clapboard, asbestos shingles, stucco, stone or insulated siding can be substituted for brick facing. The first four mentioned kinds of building materials may again replace insulated sidings. Fibreboard and gypsum board can replace one another while vitrified sewer pipes may be replaced by concrete pipes or, in certain sizes, by fibre pipes. There is, however, a physical limitation to the possibility of substitution.[1] Some interior materials are likely to be replaced by others only if they are about equal in terms of durability and performance. Substitution is also influenced by the consumer's ideas as to aesthetic values and by the price of alternative materials available.

In this study the most common items were included as actual requirements with the possibility of substitution of other items commonly used being indicated in the notes discussing the estimates. The substitute items enumerated, however, can only be regarded as illustrative as no attempt was made to cover all possible substitutes.

(e) *Quality and Price.* In choosing a particular kind of building material or equipment, the consumer, if well advised, will be guided to a large extent by the quality and serviceability of the materials or equipment he selects. At times, of course, availability of supply is an over-riding consideration and needs for new housing accommodation are so pressing that less care is taken in insisting on high standards of materials than would otherwise be the case.[2] But under normal circumstances, standards of performance of materials and equipment have a great influence on the selection.

Closely tied in with the quality of building materials is their cost. Of course the quality of the product will have a bearing on its price but there are many other factors such as the degree of mechanization of the enterprise, the efficiency in management, the skill of the labour force, the distance from the market (transportation costs[3]), and trade practices, i.e., the conditions under which

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[1] The possibility of substitution is greater in the interior building materials field than in that of exterior materials because of the greater variety available.

[2] An example of this practice is the use, at times, of green and unseasoned lumber (with resultant depreciation of frame dwellings due to the warping of such lumber) and of the poorer grades of hardwood flooring as a result of inadequate supplies of seasoned lumber.

[3] To cite an example: A house built in or near a lumber producing area (British Columbia) has an advantage due to a lower freight cost over one built in a community farther from the source of supply (Prairies). Further, availability of materials locally or regionally expedites delivery to the site and avoids delays that might otherwise be experienced if materials are hauled over long distances. In still other cases, building materials may be so bulky as to make movement over long distances uneconomical as in the case of bricks. With capacity of brick production unevenly distributed, this material can, in certain areas, be obtained only at a relatively high cost per unit, or else be replaced by alternative materials. To-day this is being done to an increasing extent in most areas by using lumber or concrete masonry blocks for wall construction.

production and distribution are carried on.[1] In times when supply exceeds demand, buyers of large quantities of materials are in a good bargaining position which frequently enables them to obtain price concessions on a unit basis, not available to the buyer of small quantities. Further, bulk transportation and storage handling on a large scale will contribute to real economies on the basis of cost per unit of materials.

Regional variations of quality and current prices of building materials were taken into consideration in arriving at the estimates presented here.[2]

(f) *Availability of Skilled Building Mechanics.* Availability of labour qualified to handle building materials is another factor determining the kinds of materials that will be used in a locality. If, for example, production of bricks in 1946 increases substantially above the level of 1945, a year of low production[3], the number of bricklayers available (including graduates of training courses) may not suffice to lay all the bricks produced unless, of course, output per man-hour increases substantially above the present average. The bricklaying trade in Canada is a craft marked by a concentration of building mechanics in the older age groups with only comparatively few younger men having the necessary skill. Because of the shortage of skilled bricklayers, there has been a tendency during the past few years to resort to the rougher kind of masonry where terra cotta or concrete masonry blocks are used, all requiring less skill in laying, and where the exterior surface is covered with stucco. While there will be some improvement in the labour situation in 1946 and 1947 as compared with 1945 because of the return of skilled building mechanics from the armed forces, the retraining and upgrading of veterans wanting to become building mechanics and the speed-up in the regular apprenticeship training schemes, the improvement in the labour situation is not likely to change the pattern of housing construction in Canada to any considerable degree in the immediate future.

(g) *Climatic Conditions.* The enumeration of factors determining building material requirements would not be complete if account were not taken of the wide expanse and the varied climatic conditions of Canada, which result in regional variations in construction methods and in types of structures erected and hence varied regional material patterns. Thus, while it is possible in the West, as a result of climatic conditions, to build some houses without basements and with little or no insulation, such construction methods are not very common in Central Canada and the Maritimes. Allowance for this factor was made in choosing the frequency distribution of houses currently constructed in Canada.

(h) *The Effect of Building Codes and By-laws.* Many municipalities are divided or zoned into fire limits for purposes of safety. The degree of fire hazard determines the types of construction prescribed in conformity with fire limit requirements. Building by-laws in some municipalities prohibit the use of exterior wall or roof construction which is not fire retardant. Thus, while brick veneer or other non-combustible materials might be used, wood clapboard might be prohibited. The effect of building codes and by-laws is reflected in the building pattern of 1945 and no significant change on this count is expected in 1946 and 1947.

The above principles which determine the effective demand for building materials required to accomplish a given housing target should be borne in mind when appraising the estimates of material requirements given below. The data are shown as national averages and were arrived at by using a frequency distribution of types of structures most commonly built. While they take account of regional and local variations, the statistics given do not necessarily apply to particular localities or regions.

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(1) Price rigidity will take place in such sectors of the building material field where tendencies to restrictive practices become pronounced.

(2) For method of computation, see Notes to Tables VI-XXII, Appendix A.

(3) In 1945 production of building brick (face and common) amounted to 184,000,000. This output is substantially below that of the 'twenties though it is slightly above the pre-war level of the late 'thirties. Production in 1929 amounted to 446,000,000 bricks and in 1939 to 165,000,000 bricks.

2. *Estimates of Requirements*

If 50,000 housing units are built in the current year, this will mean orders for manufacturers and distributors of building materials varying between $144 million and $175 million (including transportation costs to the site) depending on the standard of the housing program. These orders will be distributed among nine major supply industries (see Table 12 and Figure 8). As the housing target increases, some 20 per cent has to be added to the building material requirements for every 10,000 additional units. Requirements are discussed in summary fashion in the following text and are shown in more detail in Tables 13 to 16.

TABLE 12.—VALUE AND DISTRIBUTION OF BUILDING MATERIAL REQUIREMENTS OF HOUSING TARGET, ON THE BASIS OF DESIRABLE AND ACTUAL STANDARDS, BY NINE MAJOR CLASSIFICATIONS

(Thousands of Dollars)

Kind of building material used	Percentage distribution	Housing target			
		50,000 units	60,000 units	70,000 units	80,000 units
Desirable Standards—					
I. Cement, gravel and sand	7·61	13,340	16,008	18,676	21,344
II. Brick, tile and stone	4·97	8,700	10,440	12,180	13,920
III. Lumber and its products	42·64	74,705	89,646	104,587	119,528
IV. Lath, plaster and insulation materials	11·31	19,808	23,770	27,731	31,693
V. Roofing materials	2·89	5,068	6,082	7,095	8,109
VI. Paint and glass	3·20	5,611	6,733	7,856	8,977
VII. Plumbing and heating equipment and fixtures	18·57	32,531	39,037	45,544	52,050
VIII. Electrical equipment and fixtures	3·85	6,753	8,104	9,454	10,805
IX. Other building materials	4·96	8,682	10,418	12,155	13,891
Total	100·00	175,198	210,238	245,278	280,317
Actual Standards—					
I. Cement, gravel and sand	7·61	10,987	13,185	15,382	17,579
II. Brick, tile and stone	4·97	7,175	8,610	10,045	11,480
III. Lumber and its products	42·64	61,562	73,874	86,187	98,499
IV. Lath, plaster and insulation materials	11·31	16,329	19,595	22,861	26,126
V. Roofing materials	2·89	4,172	5,006	5,841	6,675
VI. Paint and glass	3·20	4,620	5,544	6,468	7,392
VII. Plumbing and heating equipment and fixtures	18·57	26,811	32,173	37,535	42,898
VIII. Electrical equipment and fixtures	3·85	5,558	6,670	7,781	8,893
IX. Other building materials	4·96	7,161	8,593	10,025	11,458
Total	100·00	144,375	173,250	202,125	231,000

Source: See Appendix A.

(a) *Cement, Gravel and Sand*

In the cement, gravel and sand industry, manufacturers and distributors will do an estimated business of $13·3 million, or 7·6 per cent of the total amount to be spent on building materials. Expenditures will be made on:

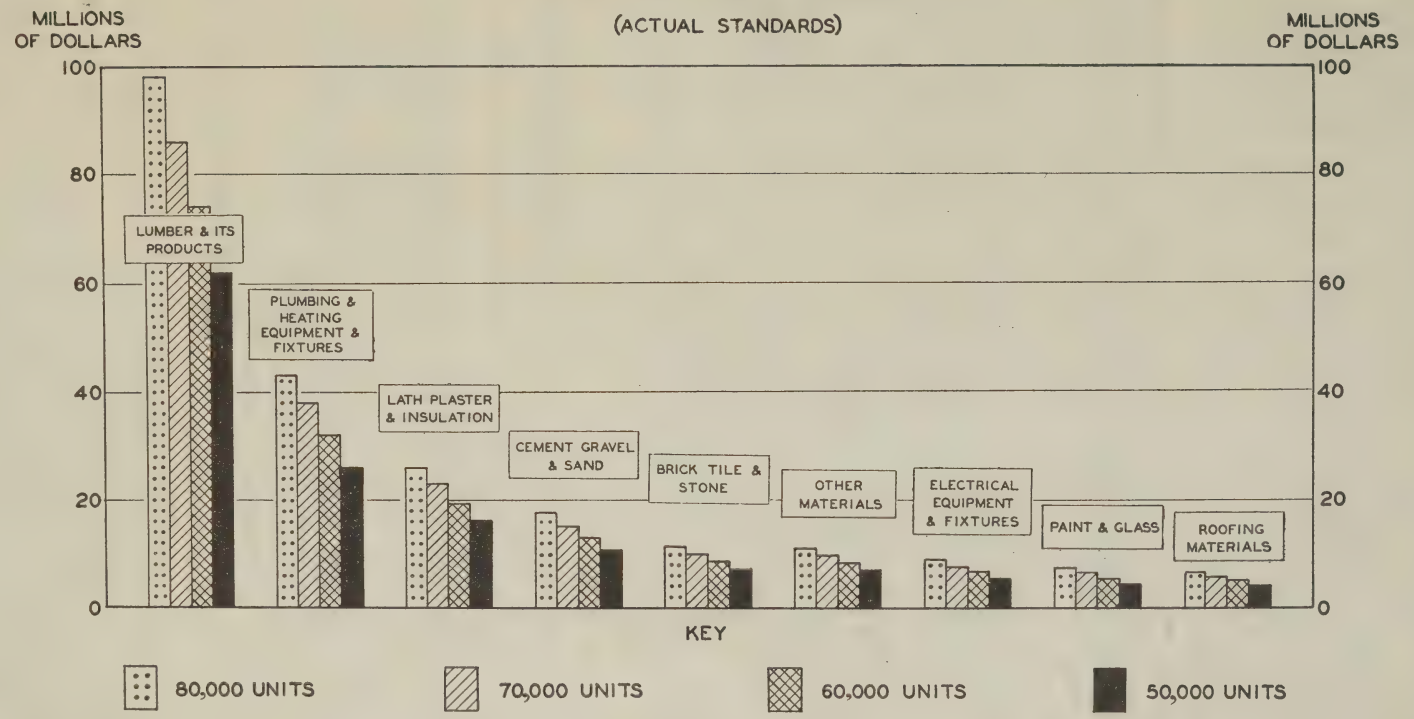
Cement for footings and concrete foundation walls[1] and piers; exterior cement finish for foundation walls above grade and basement floor slab. Sales are likely to total 11·1 million bags of 87·5 lbs. each or 2·8 million barrels of 350 lbs. each at a value of $7·8 million.

Aggregates for concrete—combination of sand and gravel or sand and stone—which are used together with cement. Purchase of 2·5 million cubic yards of aggregates for concrete valued at $3·7 million may be anticipated.

[1] For foundation walls, concrete masonry blocks might be used instead of poured concrete when manufactured and built to comply with the requirements of local by-laws for foundation walls.

FIGURE 8 – SHARE OF CONSTRUCTION COSTS GOING TO INDUSTRIES SUPPLYING BUILDING MATERIALS FOR HOUSING TARGET

(ACTUAL STANDARDS)



SOURCE OF DATA: SEE APPENDIX A.

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Concrete masonry blocks—cinder or stone concrete blocks with the former an aggregate of cinder, sand and cement and the latter a stone, sand and cement aggregate.[1] Recent trends in building practice indicate that more and more home builders are finding it economical to produce these blocks at or near the site instead of purchasing them from manufacturers or distributors. This trend is fostered by the fact that more hand-operated concrete block-making machinery is becoming available. Blocks produced on the site for use in the locality have to conform to the requirements of municipal by-laws. Estimated requirements are placed at 9·3 million ready-to-use masonry blocks valued at $1·9 million.

(b) *Brick, Tile and Stone*

Expenditures on brick, tile and stone are likely to be of the order of $8·7 million, or 5 per cent of the total to be expended. Purchases will be made of:

Bricks for chimneys and exterior walls. The greater number of houses having bricks in their exterior wall construction would be in the Toronto-Hamilton area, in Montreal and Quebec City, and in the Maritimes, where brick is more readily available and where it is economical to use it.[2] The percentage distribution of the housing target, by kinds of building materials used (see Table 4) denotes that approximately 30 per cent of the total number of houses would have brick in their exterior wall construction. It is anticipated that requirements will total 46 million bricks for chimneys at a cost of $1·2 million and 169 million bricks for exterior walls at a cost of $5·6 million, a total of 215 million bricks involving an outlay of $6·8 million.

Stone facing—a kind of masonry veneer known as "crazy" work which is of random, irregular work in which an irregular small quarry stone is used. This class of work is restricted to certain areas where stone is readily available. Some 67,000 sq. yds. of stone facing will be purchased at a cost of $303,000.

Field tile for sub-drainage (agricultural clay pipe). Some 7·7 million feet involving an outlay of $617,000 may be used.

Vitrified flue linings. Requirements for use in chimneys are put at 2 million feet costing $993,000.

(c) *Lumber and Its Products*

The lumber (and millwork) industry can expect the largest proportion of expenditures for building materials—some $74·7 million or 42·6 per cent of total estimated expenditures for materials. Purchases involving a total of some 759 million board feet will be made of:

Structural (dimension) lumber [3] comprising timber for exterior wall framing, floor and ceiling joists, roof members, built-up beams and interior partition studding. Sales of 279 million board feet valued at $18·6 million are foreseen.

Yard lumber, rough and surfaced[4] which consists of nominal thickness boarding for inner and outer sheathing of wood framed exterior walls and the roof and of boarding to serve as under-flooring. Some 260·4 million board feet will likely be bought at a cost of $16 million.

Wood clapboard for exterior walls [5] i.e., exterior finish boardings, of which an estimated 40·1 million sq. ft. (40·1 million board feet) will be sold for $4 million.

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[1] In certain areas, where the cost factor permits, terra cotta hollow clay tile (structural tile or masonry blocks) might be used as an alternative to concrete masonry blocks.

[2] While production of brick is chiefly centred in these areas, it is also produced in the Prairie Provinces and British Columbia but the quantities are much smaller.

[3] Where air-dried structural lumber (and yard lumber) is in short supply and therefore not available, it might be found necessary to use green lumber (the determinant of which is the moisture content). In such cases it is considered desirable to treat the green lumber with a water-repellent.

[4] In certain districts where building by-laws permit and where freight charges from the source of manufacture do not make their use prohibitive, laminated fibre board or gypsum board sheathing would be an economical substitute for outer and inner lumber sheathing of exterior timber framed walls.

[5] Alternative materials are *(a)* cement asbestos siding shingles which in certain districts could be obtained on a favourable competitive basis, *(b)* wood shingles and *(c)* imitation brick (asphalt-felt) siding and insulated imitation brick (asphalt-felt) siding.

Exterior millwork, i.e., trim for doors, windows, porch frames and cornices. Expenditure will possibly be made on 60·3 million board feet of outside millwork valued at $12·1 million.

Hardwood flooring which is of mill-run grade birch and maple species of No. 2 and better grades. Sales are expected to total 40·7 million board feet valued at $5·5 million.

Softwood flooring of which some 29·9 million board feet costing $2·2 million will likely be used.

Interior millwork for doors, doors and windows trim, baseboards and kitchen cupboards. Purchases will in all probability amount to 48·5 million board feet valued at $16·2 million.

Strapping—a nailing strip for lath on walls and ceilings. An alternative material is furring. Sales are likely to total 3·3 million linear feet (some 552,000 board feet) valued at $66,000.

(d) *Lath, Plaster and Insulation Materials*

The producers of lath, plaster and insulation materials can expect to do business totalling $19·8 million, 11·3 per cent of total expenditures for building materials. The $19·8 million—which amounts to the third largest share of total expenditures for materials—will be expended on:

Insulating materials—rock (mineral) wool batts[1] for exterior walls and upper ceiling. Use will be made of an estimated 81·2 million sq. ft. valued at $4·9 million.

Interior plaster which is on standard gypsum lath.[2] Possible purchases will total 19·4 million sq. yds. (77·7 thousand tons) at a cost of $11·6 million.

Building paper for inside use (asphalt saturated kraft paper) and building paper for outside use (standard asphalt or tar saturated rag felt). Expenditure on building paper for inside use, estimated at $741,000, will purchase 256,000 rolls (8·2 thousand tons); expenditure on building paper for outside use, estimated at $621,000, will purchase 289,000 rolls (7·5 thousand tons).

Exterior plaster (ready-to-use stucco). Some 1·5 million sq. yds. costing $2 million will probably be used.

(e) *Roofing Materials*

Manufacturers and distributors of roofing materials will receive a comparatively small share of expenditures for materials—a possible $5·1 million or 2·9 per cent of the total. Sales will consist of:

Roofing shingles, i.e., asphalt and wood shingles.[3] Use of 593,000 squares of roofing shingles at a cost of $4·7 million is anticipated.

Dry felt for roofing (20-year roof). Some 11,000 rolls (858 tons) at a cost of $7,000 will be the likely requirements.

Tar felt for roofing. Some 60,000 rolls (1·6 thousand tons) at a cost of $155,000 will be the likely requirements.

Pitch and gravel required for the construction of flat roofs.[4] Estimated needs total 6·4 million pounds of tar (3·2 thousand tons) valued at $144,000 and 9 thousand tons of gravel valued at $22,000.

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[1] Insulation board (of wood fibre) is an alternative material; bark wool as produced on the West Coast might also be used.

[2] Alternatives to gypsum lath are standard size fibre board lath (i.e., insulating lath) or wood lath. Gypsum or fibre wallboard can be used instead of plaster. Standard size fibre lath or insulating lath might be used as a plaster base, which under certain climatic conditions would serve instead of or complement rock wool insulation.

[3] A substitute in roofing is cement asbestos (rigid) roof shingles which may be used as an alternative to asphalt and wood shingles in those areas where their use would not be prohibitive, due to freight charges from point of manufacture. Because of their fire-retardant properties use of cement asbestos shingles would conform to by-laws of certain cities.

[4] Asphalt may be used as an alternative to tar and gravel.

(f) *Paint and Glass*

The paint and glass industries can expect an estimated sale of their products amounting to $5·6 million, or 3·2 per cent of the total expenditures. The following outlays are likely to be made:

Glass (flat, clear sheet window glass). Use of 9·6 million sq. ft. valued at $1·5 million is foreseen.

Oil paint for outside use. Some 221,000 gallons at a cost of $885,000 will probably be sold.

Paint for inside use. Mainly oil paint is likely to be required[1] with demand placed at some 306,000 gallons at a cost of $1·2 million.

Varnish. Purchases will be made of a possible 293,000 gallons selling at $1·8 million.

Shellac. Some 50,000 gallons at a cost of $301,000 will likely be used.

(g) *Plumbing and Heating Equipment and Fixtures*

Manufacturers and distributors of plumbing and heating equipment and fixtures will receive the second largest share of expenditures for materials. They will do an estimated business of $32·5 million, or 18·6 per cent of the total to be spent on building materials. Sales are likely to be made comprising the following items:

Cast iron (6 and 4 inch) plumbing pipe (commonly known as soil pipe) with fittings. Use will be made of an estimated 23,000 linear feet of 6 inch pipe with fittings (mainly for large apartment houses) at a cost of $41,000[2] and of 3·2 million linear feet of 4 inch pipe with fittings at a cost of $5·1 million. Expressed in tons, sales are anticipated of 169 tons of 6 inch pipe (single and double hub) and of 84 tons of 6 inch fittings; of 13,218 tons of 4 inch pipe (single and double hub) and of 6,786 tons of 4 inch fittings; a total of 20,257 tons of cast iron soil pipe and fittings.

Galvanized steel (2 inch, 1½ inch, 1¼ inch, 1 inch) plumbing pipe with fittings. Possible purchases will consist of: 1·5 million linear feet of galvanized steel (2 inch) plumbing pipe[3] with fittings at a cost of $825,000; 2·5 million linear feet of 1½ inch pipe with fittings at a cost of $1·2 million; 1·5 million linear feet of 1¼ inch pipe with fittings at a cost of $670,000; and 70,000 linear feet of 1 inch pipe with fittings at a cost of $24,000. Expressed in tons, sales are likely to total 2,757 tons of galvanized steel (2 inch) plumbing pipe; 3,366 tons of 1½ inch pipe; 1,699 tons of 1¼ inch pipe; and 59 tons of 1 inch galvanized steel plumbing pipe or a total of 7,881 tons of galvanized steel plumbing pipe.

Galvanized steel (½ inch) water plumbing pipe.[4] Some 5·7 million linear feet (or 2,435 tons) costing $857,000 will likely be purchased.

Lead plumbing pipe (¾ inch) water service.[5] This type of pipe is used in cases where the water service is brought into the house through the foundation. Sales are foreseen of 2·4 million linear feet (or 3,531 tons) of pipe at $1·1 million.

Total quantities of plumbing pipe and fittings required are likely to involve 34,104 tons of pipes and fittings of various kinds and uses.

Warm air and hot water heating furnaces. Requirements are estimated at 43,000 furnaces at a cost of $4·6 million. Warm air furnaces are most commonly used in single, multiple unit and row houses, while hot water furnaces are most commonly used in apartment houses.

Wrought iron hot water pipe (4 inch, 3 inch, 2 inch) with fittings used for heating. Purchases will probably be made of: 29,000 linear feet (or 158 tons) of

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(1) Casein water-mixed paint can be used as an alternative.
(2) Unit cost per foot of all plumbing pipe used in this study includes costs of fittings, traps, clean-outs, roof flange, etc., and caulking lead, etc.
(3) Cast iron (2-inch) soil pipe when available might be used instead of 2-inch steel pipe.
(4) An alternative material would be streamline copper tubing M grade.
(5) Streamline copper tubing K grade can be used as an alternative.

4 inch pipe with fittings at a value of $40,000; 29,000 linear feet (or 110 tons) of 3 inch pipe with fittings at a value of $30,000; and 59,000 linear feet (or 109 tons) of 2 inch pipe with fittings at a value of $32,000. Expressed in tons, sales are likely to total 377 tons of wrought iron hot water pipe with fittings.

Cast iron radiators. Some 233,000 sq. ft. involving 581 tons at a cost of $128,000 will be the likely requirements.

Toilets, consisting of complete sets of sanitary closet bowls, tanks and seats. Use will likely be made of 50,000 units valued at $1·6 million.

Wash basins (china wall hung lavatories, complete). Purchase of 50,000 basins—porcelain enamelled and vitreous china—at $1·3 million is anticipated.

Porcelain enamelled cast iron recess bathtubs. Average cost per bathtub for a 50,000 unit housing program is estimated to amount to about $80. If a shower (stall with shower head and pan) is substituted for a bathtub, the cost per unit is reduced to $40. This would involve a saving of about 50 per cent of the cost of a bathtub. Some dwelling units, of course, will have neither a bathtub nor shower because they will lack running water, but since the housing target has been estimated on the basis of desirable standards, one unit (bathtub or shower) has been allowed for each structure. In addition, a few luxury types of structures may be built during 1946-1947 containing two bathtubs or combination bathtub and shower fixtures. Sales in all likelihood will total 50,000 units valued at $3·9 million.

Porcelain enamelled cast iron combination laundry tubs and sinks (for kitchen). If the program can absorb 50,000 units, which would be the case if every unit were built of a desirable standard, this would involve an expenditure of $2·5 million.

Domestic hot water heaters (coal, electric, gas), consisting of a combination tank heater with range boiler (or tank) and stand. A 30 gallon capacity tank is used in single, multiple unit and row houses. Capacity of hot water heater used in apartments (with hot water furnace) is 500 gallons or more. Estimated sales are placed at 49,000 units valued at $1·5 million.

Vitrified clay sewer drain.[1] Requirements will likely total 2·3 million feet involving an outlay of $920,000.

Smoke pipes and warm air ducts for furnaces made of galvanized sheet steel. Some 15·4 million sq. ft. costing $6·2 million are the estimated purchases.

(h) *Electrical Equipment and Fixtures*

The electrical equipment and fixtures industry will manufacture and distribute products to the value of an estimated $6·8 million. The industry will obtain 3·9 per cent of the total to be expended on building materials.

Expenditures are likely to be made on:

Electrical wiring and accessories, valued at a possible $4·4 million, which sum will purchase entrance and single pole switches, combination panels, conduits, fittings, wire, connectors, receptacles, outlet boxes, fuses (cartridge and plug), etc.

Electrical fixtures. Expenditures for these are estimated at $2·3 million.

(i) *Other Materials*

Estimated sales of other building materials, mainly steel and sheet metal (sheet steel) articles, will amount to $8·7 million, or 5 per cent of the total. Purchases will include:

Metal window (sash) balances. Anticipated requirements will amount to 694,000 pairs, selling for $902,000.

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[1] Alternative materials are concrete sewer pipe or fibre drain pipe, which can be substituted in certain districts provided their use meets the requirements of authorities having jurisdiction.

Metal weatherstrips for windows and doors. It is expected that some 11·3 million feet selling for $1·1 million will be bought.

Sheet metal eavestroughs and sheet metal down spouts. Use is foreseen of 4·7 million linear feet (1·5 thousand tons) of eavestroughs valued at $1·4 million, and of 2 million linear feet (617 tons) of down spouts valued at $592,000.

Sheet metal roof flashings, used chiefly around chimneys and windows piercing the main roof. Roofers generally make up their own flashings to suit the job. (This is also done at times in the case of eavestroughs, although these are usually bought ready-for-use). Some 2·6 million sq. ft. (972 tons) of roof flashings costing $778,000 are expected to be used.

Rough hardware. Probable requirements will be of the order of 16·8 million lbs. (168,000 kegs of nails equal to 8,378 tons) at a cost of $1·3 million.

Finish hardware. Sales are estimated to total $2·3 million.

Damp proofing—an asphalt or a tar base (bituminous coating or liquid) produced by manufacturers of roofing materials. Use is anticipated of 180,000 gallons at a cost of $243,000.

Linoleum, used in main entrances to apartment houses.[1] Sales are foreseen of 12,000 sq. yds. valued at $20,000.

How widely diffused the economic effects of large orders for building materials and equipment are becomes evident from the wide range and substantial physical quantities of raw materials which will be used in their production. Almost all the raw materials required are available in this country, and to a large extent they are processed here. Thus, house-building activity will have a very stimulating effect on a wide range of endeavour. This is an important consideration, not only from the immediate point of view of effect on the level of employment and income in the transition period, but also from the long-term point of view of stabilizing the level of activity of a significant segment of Canadian industry.

Requirements for lumber, bricks, iron and steel head the list. Requirements for these basic commodities are placed at some 759 million board feet of lumber, 215 million bricks, and many thousands of tons of iron and steel and other mineral products required to produce some 14 million linear feet of plumbing and water pipes and fittings, 3·2 million linear feet of soil pipes and fittings, and many thousands of plumbing and heating equipment units. Other requirements involve materials for some 81 million sq. ft. of insulating materials of all kinds, 19 million sq. yds. of interior plaster,[2] some 10 million sq. ft. of window glass, and close to a million gallons of paint, varnish and shellac, and a multitude of other commodities used in residential construction.

While this study is confined to a measurement of requirements for building materials of a given housing target and does not appraise in any detail the present supply situation, a careful analysis of present production trends indicates that Canada's productive capacity, if not interrupted by industrial strife, is sufficiently developed to produce the materials required for a housing program of 60,000 units during 1946-1947 and still provide substantial quantities of materials needed for essential industrial and commercial projects—provided of course that fullest use of the resources of this country is made.[3] For the years beyond 1946-1947, the great development of Canadian industry holds promise for housing programs that would exceed the accomplishments of any pre-war year or those of the transition period.

This conclusion is supported by the fact that Canada's industrial capacity was considerably expanded during the last six years. To illustrate this point a few

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[1] No account is taken here of the requirements of linoleum for covering floors inside houses or apartments.

[2] Many of these products will require additional quantities of basic raw materials. Thus, to mention but a few, the manufacture of lath will require wood and steel, the manufacture of plaster will require sand and lime, while the production of roofing materials will require lumber, sheet steel, asphalt and asbestos.

[3] This does not mean that the total demand for construction forthcoming during 1946 and 1947 can be met in these two years. Some less essential construction might have to be postponed to 1948 and the years that follow.

figures are given, both on some raw material items and some manufactured commodities.[1] The production of lumber, which amounted to less than 4 billion board feet in 1939, increased by almost 25 per cent to an estimated 4·9 billion board feet in 1945. During the same period, the production of iron ore increased nearly 10 times rising from 124,000 tons to an estimated 1,135,000 tons. Even in the brick industry which experienced a great shortage of labour during the war years, production increased from 165 million bricks (common and face) in 1939 to 184 million in 1945. Expansion of manufacturing capacity is even more pronounced, particularly in the steel industry. Annual production of steel ingots and castings amounted to 1,383,000 tons when the war broke out, but had risen to 2,879,000 tons six years later. In the same period, production of cement increased from 5·7 million barrels to 7·8 million barrels (of 350 pounds each). Most spectacular was the increase in the production of asphalt shingles which trebled during the same period from 490,000 squares in 1939 to 1·4 million squares in 1945. Similarly, production of mineral-surfaced roofing rose from 360,000 squares to 1·2 million squares. Increases were also registered in fields where shortages have been great during the war years, such as cast iron soil pipe and fittings. The production of this commodity increased from about 16,000 tons in 1939 to 21,000 tons in 1945. Substantial increases were also registered in the production of gypsum wall board, where the output more than doubled from 78 million sq. ft. to 179 million sq. ft. in the years 1939-1944.[2] In the same period the annual production of steel pipes, tubes and fittings rose from 91,000 tons to 136,000 tons.[3]

The expansion in these and allied industries holds promise to retain for the future most of the benefits which came from the development of industrial capacity during the war. It will contribute to the raising of the standard of living of the Canadian people with the improvement of housing playing an important part in the achievement of this aim.

(1) All figures are rounded to the nearest million or nearest thousand.
(2) Figures for 1945 are not available at present.
(3) All data on production by courtesy of the Dominion Bureau of Statistics, except data on the production of steel ingots and castings, which were supplied by courtesy of the Steel Controller, Department of Reconstruction and Supply.

TABLE 13.—VALUE AND UNITS OF BUILDING MATERIAL REQUIREMENTS OF A 50,000 UNIT HOUSING TARGET, BY SIXTY-THREE DETAILED CLASSIFICATIONS

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$	000	$000
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	·70	11,095	7,766
(2) Aggregates for concrete	Cu. yds.	1·50	2,476	3,715
(3) Masonry blocks	No.	·20	9,295	1,859
Sub-total	—	—	—	13,340
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26·03M	46,063	1,199
(5) Brick for exterior walls	No.	33·00M	169,321	5,588
(6) Stone facing	Sq. yds.	4.50	67	303
(7) Field tile sub-drainage	Ft.	.08	7,715	617
(8) Vitrified flue linings	Ft.	.50	1,986	993
Sub-total	—	—	—	8,700
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	66.56M	278,970	18,567
(10) Yard lumber, rough and surfaced	B.M. ft.	61.52M	260,396	16,020
(11) Wood clapboard for exterior walls	Sq. ft.	.10	40,083	4,008
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	60,334	12,067
(13) Flooring—hardwood	B.M. ft.	135.00M	40,722	5,498
(14) Flooring—softwood	B.M. ft.	75.00M	29,850	2,239
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	44,522	10,240
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	4,000	6,000
(17) Strapping	L. ft.	.02	3,309	66
Sub-total	—	—	—	74,705
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	81,195	4,872
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	19,437	11,598
(20) Building paper—inside	Rolls	2.90	256	741
(21) Building paper—outside	Rolls	2.15	289	621
(22) Exterior plaster—stucco	Sq. yds.	1.32	1,494	1,976
Sub-total	—	—	—	19,808
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	593	4,740
(24) Roofing—dry felt (20 year roof)	Rolls	.60	11	7
(25) Roofing—tar felt	Rolls	2.60	60	155
(26) Roofing—pitch	Lbs.	·0225	6,401	144
(27) Roofing—gravel	Tons	2.60	9	22
Sub-total	—	—	—	5,068
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	9,569	1,450
(29) Paint—outside (oil)	Gals.	4.00	221	885
(30) Paint—inside	Gals.	3.98	306	1,219
(31) Varnish	Gals.	6.00	293	1,756
(32) Shellac	Gals.	6.00	50	301
Sub-total	—	—	—	5,611

TABLE 13.—VALUE AND UNITS OF BUILDING MATERIAL REQUIREMENTS OF A 50,000 UNIT HOUSING TARGET, BY SIXTY-THREE DETAILED CLASSIFICATIONS—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$	000	$000
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings..	L. ft.	1.75	23	41
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	3,185	5,096
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	1,499	825
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	2,465	1,232
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	1,490	670
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	.35	70	24
(39) Plumbing—½″ galvanized steel water pipe.	L. ft.	.15	5,716	857
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	2,354	1,060
(41) Heating—warm air and hot water furnaces	No.	107.45	43	4,590
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	1.40	29	40
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	1.05	29	30
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	.55	59	32
(45) Cast iron radiators	Sq. ft.	.55	233	128
(46) Toilets	No.	31.94	50	1,585
(47) Wash basins	No.	26.94	50	1,337
(48) Bathtubs	No.	79.55	50	3,948
(49) Combination tub and sink	No.	49.85	50	2,474
(50) Domestic hot water heater	No.	30.17	49	1,482
(51) Vitrified clay sewer drain	Ft.	.40	2,301	920
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	15,400	6,160
Sub-total	—	—	—	32,531
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	4,445
(54) Electrical fixtures	—	—	—	2,308
Sub-total	—	—	—	6,753
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	694	902
(56) Metal weatherstrips	Ft.	.10	11,274	1,127
(57) Sheet metal eavestroughs	L. ft.	.30	4,740	1,422
(58) Sheet metal down spouts	L. ft.	.30	1,975	592
(59) Sheet metal roof flashings	Sq. ft.	.30	2,592	778
(60) Rough hardware	Lbs.	.08	16,757	1,340
(61) Finish hardware	—	—	—	2,258
(62) Damp proofing	Gals.	1.35	180	243
(63) Linoleum	Sq. yds.	1.65	12	20
Sub-total	—	—	—	8,682
Total	—	—	—	175,198

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE 14.—VALUE AND UNITS OF BUILDING MATERIAL REQUIREMENTS OF A 60,000 UNIT HOUSING TARGET, BY SIXTY-THREE DETAILED CLASSIFICATIONS

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$	000	$000
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	13,314	9,320
(2) Aggregates for concrete	Cu. yds.	1.50	2,972	4,457
(3) Masonry blocks	No.	.20	11,154	2,231
Sub-total	—	—	—	16,008
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.03M	55,275	1,439
(5) Brick for exterior walls	No.	33.00M	203,185	6,705
(6) Stone facing	Sq. yds.	4.50	81	363
(7) Field tile sub-drainage	Ft.	.08	9,259	741
(8) Vitrified flue linings	Ft.	.50	2,384	1,192
Sub-total	—	—	—	10,440
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	66.56M	334,764	22,281
(10) Yard lumber, rough and surfaced	B.M. ft.	61.52M	312,475	19,224
(11) Wood clapboard for exterior walls	Sq. ft.	.10	48,100	4,810
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	72,401	14,480
(13) Flooring—hardwood	B.M. ft.	135.00M	48,866	6,597
(14) Flooring—softwood	B.M. ft.	75.00M	35,820	2,687
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	53,426	12,288
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	4,800	7,200
(17) Strapping	L. ft.	.02	3,971	79
Sub-total	—	—	—	89,646
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	97,435	5,846
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	23,324	13,918
(20) Building paper—inside	Rolls	2.90	307	890
(21) Building paper—outside	Rolls	2.15	348	745
(22) Exterior plaster—stucco	Sq. yds.	1.32	1,792	2,371
Sub-total	—	—	—	23,770
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	711	5,688
(24) Roofing—dry felt (20 year roof)	Rolls	.60	13	8
(25) Roofing—tar felt	Rolls	2.60	72	186
(26) Roofing—pitch	Lbs.	.0225	7,682	173
(27) Roofing—gravel	Tons	2.60	10	27
Sub-total	—	—	—	6,082
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	11,482	1,740
(29) Paint—outside (oil)	Gals.	4.00	265	1,062
(30) Paint—inside	Gals.	3.98	367	1,463
(31) Varnish	Gals.	6.00	351	2,107
(32) Shellac	Gals.	6.00	60	361
Sub-total	—	—	—	6,733

TABLE 14.—VALUE AND UNITS OF BUILDING MATERIAL REQUIREMENTS OF A 60,000 UNIT HOUSING TARGET, BY SIXTY-THREE DETAILED CLASSIFICATIONS—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$	000	$000
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings	L. ft.	1.75	28	49
(34) Plumbing—4″ cast iron pipe with fittings	L. ft.	1.60	3,822	6,115
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	1,799	989
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	2,958	1,479
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	1,788	805
(38) Plumbing—1″ galvanized steel pipe and fittings	L. ft.	.35	84	29
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	6,859	1,029
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	2,825	1,271
(41) Heating—warm air and hot water furnaces	No.	107.45	51	5,508
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	1.40	35	48
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	1.05	35	36
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	.55	70	39
(45) Cast iron radiators	Sq. ft.	.55	279	154
(46) Toilets	No.	31.94	60	1,902
(47) Wash basins	No.	26.94	60	1,604
(48) Bathtubs	No.	79.55	60	4,737
(49) Combination tub and sink	No.	49.85	60	2,969
(50) Domestic hot water heater	No.	30.17	59	1,778
(51) Vitrified clay sewer drain	Ft.	.40	2,761	1,104
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	18,479	7,392
Sub-total	—	—	—	39,037
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	5,335
(54) Electrical fixtures	—	—	—	2,769
Sub-total	—	—	—	8,104
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	833	1,082
(56) Metal weatherstrips	Ft.	.10	13,529	1,353
(57) Sheet metal eavestroughs	L. ft.	.30	5,688	1,707
(58) Sheet metal down spouts	L. ft.	.30	2,370	711
(59) Sheet metal roof flashings	Sq. ft.	.30	3,111	933
(60) Rough hardware	Lbs.	.08	20,108	1,608
(61) Finish hardware	—	—	—	2,709
(62) Damp proofing	Gals.	1.35	216	291
(63) Linoleum	Sq. yds.	1.65	15	24
Sub-total	—	—	—	10,418
Total	—	—	—	210,238

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE 15.—VALUE AND UNITS OF BUILDING MATERIAL REQUIREMENTS OF A 70,000 UNIT HOUSING TARGET, BY SIXTY-THREE DETAILED CLASSIFICATIONS

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$	000	$000
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	15,533	10,873
(2) Aggregates for concrete	Cu. yds.	1.50	3,467	5,200
(3) Masonry blocks	No.	.20	13,013	2,603
Sub-total	—	—	—	18,676
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.03M	64,488	1,678
(5) Brick for exterior walls	No.	33.00M	237,049	7,823
(6) Stone facing	Sq. yds.	4.50	94	424
(7) Field tile sub-drainage	Ft.	.08	10,802	864
(8) Vitrified flue linings	Ft.	.50	2,781	1,391
Sub-total	—	—	—	12,180
III. *Lumber and Its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	66.56M	390,558	25,994
(10) Yard lumber, rough and surfaced	B.M. ft.	61.52M	364,554	52,428
(11) Wood clapboard for exterior walls	Sq. ft.	.10	56,116	5,611
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	84,467	16,893
(13) Flooring—hardwood	B.M. ft.	135.00M	57,011	7,697
(14) Flooring—softwood	B.M. ft.	75.00M	41,790	3,134
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	62,331	14,336
(16) Interior millwork—kitchen cupboards	B.M. ft.	— [1]	5,600	8,400
(17) Strapping	L. ft.	.02	4,633	93
Sub-total	—	—	—	104,586
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	113,674	6,821
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	27,211	16,237
(20) Building paper—inside	Rolls	2.90	358	1,038
(21) Building paper—outside	Rolls	2.15	405	870
(22) Exterior plaster—stucco	Sq. yds.	1.32	2,091	2,766
Sub-total	—	—	—	27,732
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	830	6,636
(24) Roofing—dry felt (20 year roof)	Rolls	.60	15	9
(25) Roofing—tar felt	Rolls	2.60	84	217
(26) Roofing—pitch	Lbs.	.0225	8,962	202
(27) Roofing—gravel	Tons	2.60	12	31
Sub-total	—	—	—	7,095
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	13,396	2,030
(29) Paint—outside (oil)	Gals.	4.00	310	1,239
(30) Paint—inside	Gals.	3.98	428	1,706
(31) Varnish	Gals.	6.00	410	2,459
(32) Shellac	Gals.	6.00	70	422
Sub-total	—	—	—	7,856

TABLE 15.—VALUE AND UNITS OF BUILDING MATERIAL REQUIREMENTS OF A 70,000 UNIT HOUSING TARGET, BY SIXTY-THREE DETAILED CLASSIFICATIONS—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$	000	$000
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings	L. ft.	1.75	33	57
(34) Plumbing—4″ cast iron pipe with fittings	L. ft.	1.60	4,459	7,135
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	2,099	1,154
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	3,450	1,725
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	2,086	939
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	.35	98	34
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	8,002	1,200
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	3,296	1,483
(41) Heating—warm air and hot water furnaces	No.	107.45	60	6,426
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	1.40	40	57
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	1.05	40	42
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	.55	82	45
(45) Cast iron radiators	Sq. ft.	.55	326	179
(46) Toilets	No.	31.94	69	2,219
(47) Wash basins	No.	26.94	69	1,872
(48) Bathtubs	No.	79.55	69	5,527
(49) Combination tub and sink	No.	49.85	69	3,463
(50) Domestic hot water heater	No.	30.17	69	2,075
(51) Vitrified clay sewer drain	Ft.	.40	3,221	1,288
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	21,559	8,624
Sub-total	—	—	—	45,544
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	6,223
(54) Electrical fixtures	—	—	—	3,231
Sub-total	—	—	—	9,454
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	971	1,263
(56) Metal weatherstrips	Ft.	.10	15,784	1,578
(57) Sheet metal eavestroughs	L. ft.	.30	6,636	1,991
(58) Sheet metal down spouts	L. ft.	.30	2,765	829
(59) Sheet metal roof flashings	Sq. ft.	.30	3,629	1,089
(60) Rough hardware	Lbs.	.08	23,459	1,877
(61) Finish hardware	—	—	—	3,161
(62) Damp proofing	Gals.	1.35	252	339
(63) Linoleum	Sq. yds.	1.65	17	28
Sub-total	—	—	—	12,155
Total	—	—	—	245,278

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE 16.—VALUE AND UNITS OF BUILDING MATERIAL REQUIREMENTS OF AN 80,000 UNIT HOUSING TARGET, BY SIXTY-THREE DETAILED CLASSIFICATIONS

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$	000	$000
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	17,752	12,426
(2) Aggregates for concrete	Cu. yds.	1.50	3,962	5,943
(3) Masonry blocks	No.	.20	14,872	2,975
Sub-total	—	—	—	21,344
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.03M	73,701	1,918
(5) Brick for exterior walls	No.	33.00M	270,914	8,940
(6) Stone facing	Sq. yds.	4.50	108	485
(7) Field tile sub-drainage	Ft.	.08	12,345	988
(8) Vitrified flue linings	Ft.	.50	3,178	1,589
Sub-total	—	—	—	13,920
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	66.56M	446,352	29,707
(10) Yard lumber, rough and surfaced	B.M. ft.	61.52M	416,633	25,632
(11) Wood clapboard for exterior walls	Sq. ft.	.10	64,133	6,413
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	96,534	19,307
(13) Flooring—hardwood	B.M. ft.	135.00M	65,155	8,796
(14) Flooring—softwood	B.M. ft.	75.00M	47,760	3,582
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	71,235	16,384
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	6,400	9,600
(17) Strapping	L. ft.	.02	5,294	106
Sub-total	—	—	—	119,527
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	129,913	7,795
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	31,099	18,557
(20) Building paper—inside	Rolls	2.90	409	1,186
(21) Building paper—outside	Rolls	2.15	462	994
(22) Exterior plaster—stucco	Sq. yds.	1.32	2,390	3,161
Sub-total	—	—	—	31,693
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	948	7,584
(24) Roofing—dry felt (20 year roof)	Rolls	.60	17	10
(25) Roofing—tar felt	Rolls	2.60	96	249
(26) Roofing—pitch	Lbs.	.0225	10,242	231
(27) Roofing—gravel	Tons	2.60	14	35
Sub-total	—	—	—	8,109
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	15,310	2,321
(29) Paint—outside (oil)	Gals.	4.00	354	1,415
(30) Paint—inside	Gals.	3.98	490	1,950
(31) Varnish	Gals.	6.00	468	2,810
(32) Shellac	Gals.	6.00	80	482
Sub-total	—	—	—	8,978

TABLE 16.—VALUE AND UNITS OF BUILDING MATERIAL REQUIREMENTS OF AN 80,000 UNIT HOUSING TARGET, BY SIXTY-THREE DETAILED CLASSIFICATIONS—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$	000	$000
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings..	L. ft.	1.75	37	65
(34) Plumbing—4″ cast iron pipe with fittings..	L. ft.	1.60	5,096	8,154
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	2,398	1,319
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	3,943	1,972
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	2,383	1,072
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	.35	112	39
(39) Plumbing—½″ galvanized steel water pipe.	L. ft.	.15	9,146	1,372
(40) Plumbing—¾″ lead pipe water service.....	L. ft.	.45	3,767	1,695
(41) Heating—warm air and hot water furnaces	No.	107.45	68	7,344
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	1.40	46	65
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	1.05	46	48
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	.55	94	52
(45) Cast iron radiators	Sq. ft.	.55	372	205
(46) Toilets	No.	31.94	79	2,536
(47) Wash basins	No.	26.94	79	2,139
(48) Bathtubs	No.	79.55	79	6,316
(49) Combination tub and sink	No.	49.85	79	3,958
(50) Domestic hot water heater	No.	30.17	79	2,371
(51) Vitrified clay sewer drain	Ft.	.40	3,681	1,472
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	24,639	9,856
Sub-total	—	—	—	52,050
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	7,113
(54) Electrical fixtures	—	—	—	3,692
Sub-total	—	—	—	10,805
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	1,110	1,443
(56) Metal weatherstrips	Ft.	.10	18,039	1,804
(57) Sheet metal eavestroughs	L. ft.	.30	7,584	2,275
(58) Sheet metal down spouts	L. ft.	.30	3,160	948
(59) Sheet metal roof flashings	Sq. ft.	.30	4,148	1,244
(60) Rough hardware	Lbs.	.08	26,810	2,145
(61) Finish hardware	—	—	—	3,612
(62) Damp proofing	Gals.	1.35	287	388
(63) Linoleum	Sq. yds.	1.65	19	32
Sub-total	—	—	—	13,891
Total	—	—	—	280,317

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

APPENDIX A

Sources and Methods of Computation

APPENDIX A. SOURCES AND METHODS OF COMPUTATION

In attempting measurements of manpower and material requirements for a housing program in Canada, a great number of problems are encountered. Among the more important ones is the fact that some qualitative aspects of housing construction—the type and quality of which is greatly determined by consumer's preference—simply cannot be put into quantitative terms. Still other aspects which can be measured lose their meaning when used for other purposes than designed. This is so, for example, when national averages are applied to individual cases or when cost factors or availability of certain supplies applicable to only one locality or region are used to arrive at national totals.

An attempt has been made in this study to cope with the problems involved in the following ways: *(a)* where difficulties in measurement are encountered, they are pointed out; *(b)* where qualifications to estimates are necessary, they are given; *(c)* where a margin of error is likely to exist, its possible size is indicated; *(d)* where a range of figures is preferable to a single total because of the existence of a number of indeterminable factors, this method is used; and finally *(e)* sources and methods of computation of all tabular material are given in detail to enable the reader to judge for himself the reliability of the material assembled.

In some tables, data are rounded to the nearest thousand or million. Differences of plus or minus one will therefore occur. The following sections discuss sources and methods of computation of the tabular material assembled in the text and Appendix B, together with the sources used in the preparation of the charts and schedule included in the text.

TABLES IN THE TEXT

Table 1.—Distribution of Housing Target, by Types of Structures

A sample survey was undertaken to determine the frequency distribution of various types of houses currently constructed across Canada. The survey was based on applications for construction licences made to the Construction Controller of the Department of Munitions and Supply and approved during the month of June, 1945. The sample included 5,209 applications for construction licences for new housing units, yielding the following frequency distribution: single houses—79 per cent; multiple unit houses (2-6 units)—15 per cent; row and apartment houses (7 or more units)—3 per cent; and converted houses—3 per cent. These percentages were considered representative of different types of dwellings and were applied to a housing target, varying in dimensions from 50,000 to 80,000 units.

A check was made to obtain from another source confirmation of the fact that the overwhelming majority of residential dwellings constructed currently are single houses. Building permits issued for new housing units during 1945 by 204 municipalities reporting to the Dominion Bureau of Statistics were used for this purpose. Out of a total number of 25,634 new housing units, building permits were issued for 19,861 single units, or 77·5 per cent of the total.[1]

The figure of 77·5 per cent compares with 81·4 per cent for the sample (i.e., 79 per cent of 97 per cent after eliminating converted units). Figures for conversion in the sample and the Building Permit series are not comparable because in the sample the number of conversions is based on actual counts, while in the Building Permit series use of a statistical factor is made in cases where insufficient information is given. Relatively more use of the statistical factor is made in conversion cases than in new building units, making the former series less indicative of actual construction. A difference of 4 per cent still remains as between the results of the Building Permits and the sample. This is explained by the fact that the sample is representative of construction in Canada as a whole, while the 204 municipalities covered in the Dominion Bureau of Statistics survey include all the large urban centres where multiple dwellings are more numerous than in smaller communities, many of which are not covered in the Building Permit series. The results of the sample tie in even closer with data obtained in the count of the number of housing units actually constructed during 1945. Some 41,534 new dwelling units were erected, with single units comprising 32,626 or 78·6 per cent of the total.[2] All three surveys indicate the prevalence of single housing construction in Canada under present conditions.

Table 2.—Estimated Construction Costs of Housing Target, on the Basis of Desirable Standards, by Types of Structures

In arriving at an estimate of construction costs of the housing target, three stages were used:

(a) Subdividing the four different types of structures by the different kinds of materials used (see Table 3), it was found that there was a total of 17 units varying both in type of structure and kind of materials. The frequency

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(1) *Annual Report of Building Permits Issued in Canada*, 1945, Dominion Bureau of Statistics, Ottawa, 1946.

(2) Not included in the above totals are 5,982 conversions and 195 units not classified by type. The total number of dwelling units constructed during 1945 is reported at 47,711 units (*Housing Statistics 1946, Dwelling Units and Type of Buildings Reported by Municipalities for Four Months Ending April 30, 1946*, p. 4, Table I—Revised Summary of "Housing Statistics" for 1945, Dominion Bureau of Statistics, Ottawa, 1946). Data on conversions in this survey are not comparable with those shown in the sample because the former include a large number of new units created through conversion of barracks, other military buildings and temporary buildings used for emergency shelter purposes, not included in the latter.

distribution of the 17 different types is shown in Table I, Appendix B. The material requirements of these 17 different types of units were determined first, then multiplied by the unit price of materials representative of the country as a whole (for details, see Notes to Tables VI-XXII, Appendix A).

(b) Having determined the material costs, total construction costs for each unit were arrived at by using the following ratios: materials—52·5 per cent; labour—37·5 per cent; overhead and profits—10 per cent (for details, see Notes to Tables 6 and 8).

(c) Having determined construction costs for each of the 17 different types of units, total construction costs for each of the four groups of structures were arrived at by multiplying the value per unit by the number of units as determined by the frequency distribution for each group shown in Table I. The fact that construction costs for single houses are higher on a unit basis than costs for multiple dwellings, row, apartment and converted houses, is reflected in the percentage distribution shown in Table 2, which gives a greater weight to single houses than is shown in Table 1.

Table 3.—Distribution of Housing Target, by Kinds of Building Materials Used

Kinds of building materials used in house construction depend on a number of factors among which consumer's preference, availability of supplies, prices and quality and durability of materials are the most important ones. From the experience of more than four years of operation of Construction Control during the war it was found that seven types of houses, constructed of different materials, occurred most frequently.

In order to determine a frequency distribution of the kinds of building materials used, sample surveys were made covering separately the four different groups of dwellings: single houses, multiple unit houses, row and apartment houses and converted houses. Again applications for construction licences approved during the month of June, 1945, by the Construction Controller of the Department of Munitions and Supply were used as a basis. One thousand licences for single unit houses were examined, revealing the following distribution: Type A, wood frame with wood clapboard—53 per cent; Type B, wood frame and brick veneer—14 per cent; Type C, wood frame with stucco on lath—15 per cent; Type D, concrete masonry blocks and stucco—6 per cent; Type E, solid masonry: brick facing and masonry blocks—4 per cent; Type F, solid brick—6 per cent; Type G, solid masonry: masonry blocks with part stone facing and part stucco—2 per cent.

In the multiple housing unit group 695 housing units were examined yielding the following frequency distribution: Type A, wood frame with wood clapboard—32 per cent; Type B, wood frame and brick veneer—35 per cent; Type C, wood frame with stucco on lath—2 per cent; Type D, concrete masonry blocks and stucco—10 per cent; Type E, solid masonry: brick facing and masonry blocks—6 per cent; Type F, solid brick—14 per cent; Type G, solid masonry: masonry blocks with part stone facing and part stucco—1 per cent.

The sample for the row and apartment houses, although small, comprised all the licences granted for that particular group for the month of June. The 144 units covered indicated that only two major types were common among this group: Type B, wood frame and brick veneer—38 per cent, and Type E, solid masonry: brick facing and masonry blocks—62 per cent. The former kinds of material were generally used in row houses and the latter in large apartment houses. A greater variety of kinds of materials is being used in the construction of small apartment houses but these were covered in the multiple unit group.

For housing conversion, the kind of exterior material used is of minor importance in determining material requirements for remodelling of the interior.

For this reason, it was found unnecessary to separate the different types of converted houses. A material pattern of requirements for a Type B house, wood frame and brick veneer, which is quite common in Canada, was made available by the National Housing Administration, and was used in this connection.

After determining the different kinds of building materials used for the various structures, units using the same kinds of building materials were combined yielding the percentage distribution shown in Table 3. These percentages were then applied to a housing target varying in dimensions from 50,000 to 80,000 units.

Table 4.—Estimated Construction Costs of Housing Target, on the Basis of Desirable Standards, by Kinds of Building Materials Used

A similar technique to that mentioned in Table 2 was used to arrive at an estimate of construction costs of the housing target for the different kinds of building materials used. Construction costs for each of the 17 types comprising the housing target were multiplied by the number of units in each group and the individual sub-totals were then added to give totals for the seven kinds of exterior building materials used, as listed in Table 4. The fact that more single houses are of wood frame construction, with higher cost per unit than multiple dwellings, is reflected in the percentage distribution, so that, for example, the weight for Type A and C houses, as shown in Table 4, is greater than that shown in Table 3.

Table 5.—Number of Rooms Provided and Cubic Foot Content of Housing Target, by Types of Structures

The number of rooms per unit and cubic foot content varied for the different types of structures. New houses of the single unit type were largest with an average of six rooms and a cubic foot content of 16,200 per unit. Apartment houses with an average of $3\frac{7}{8}$ rooms and 10,125 cubic feet per unit contained the smallest units of new buildings. The conversion project taken as representative of that type of housing construction comprises three rooms per unit with a cubic foot content of 7,735 per unit (for details, see Table 9).

Applying the average number of rooms and cubic foot content per unit to the frequency distribution of the housing target as shown in Table I, Appendix B, the total number of rooms and total cubic foot content was arrived at for a housing target varying between 50,000 and 80,000 units. The average dwelling unit of a housing target of desirable dimensions was found to consist of 5·8 rooms and to have a cubic foot content of 15,639. These figures represent a weighted average, obtained by dividing the total number of rooms and total cubic foot content, computed by using the procedure arrived at above, by the number of units comprising the housing target.

Table 6.—Estimated Construction Costs of Housing Target, on the Basis of Desirable and Actual Standards, by Major Components

Construction costs of a housing program can be estimated in two ways:

(1) By assuming that all houses will be built of a "desirable" standard, that is, houses will be built in well-developed neighbourhoods, with sufficiently large building lots and will contain adequately sized rooms; will be solidly constructed and well-equipped with modern conveniences and facilities; and finally by assuming that no large-scale multi-unit developments will take place.[1]

[1] The elimination of a possible costs-savings factor for dwellings comprising a multi-unit project is a necessary statistical device because of the variation in efficiency in different projects constructed across the country. However, allowance for this factor was made in estimating construction costs on the basis of an "actual" housing target.

(2) By allowing for a number of houses which will be built of lower standard than is considered "desirable", or for lower construction costs because of bulk purchasing, site assembly, prefabrication, etc.

In order to show the possible range of construction costs of a housing target, separate computations were made for a housing program of "desirable" and "actual" standards. The term "actual" is used to indicate that, for reasons discussed below, a number of houses below a "desirable" standard are likely to be included in a housing program and that there are certain cost-reducing factors which have to be taken into account.

The average construction cost per unit in a housing target of "desirable" standards was estimated to be close to $6,700. Average cost per unit in a housing target of "actual" standards is likely to be in the neighbourhood of $5,500 for the following reasons:

(a) A great number of urban and rural communities, particularly smaller centres, do not have any building by-laws setting minimum standards for housing construction. Other cities and towns have out-moded building by-laws which set either too rigorous or too low standards. There are still other cities and towns which, though their building by-laws might be satisfactory, have not made adequate provisions for inspection, thereby lacking the facilities to enforce housing construction of "desirable" standards. Thus, many houses are likely to be built below a standard considered "desirable". This is particularly true in areas adjacent to large cities—so-called fringe developments—and in frontier areas, where building activity is usually of a haphazard character until such time as a fully grown community has developed. By that time the harm is usually done and building by-laws and building inspection which come into existence do not solve the problem created by the inclusion of a number of sub-standard homes in the new community.

(b) The average number of rooms per unit of a housing target of "desirable" standards has been taken to comprise 5·8 rooms. It is likely that the average number of rooms of a housing target of "actual" standards will be somewhat smaller than the above figure. The Housing Census taken in 1941 (on the basis of a 10 per cent sample) indicated that the average dwelling unit in the 27 largest cities of Canada with population of 30,000 and over comprised 5·4 rooms.[1] Houses constructed under Part I of the National Housing Act, 1938, during the period 1938-1941, indicated an average size of 5·2 rooms per dwelling.[2] These and similar indications allow the conclusion that the average house actually constructed during 1946 and 1947 will be slightly below 5·8 rooms per unit. If this is the case, it will contribute to the reduction of housing costs for the average unit in the housing target.

(c) Some large-scale housing projects are being undertaken in 1946 (and are likely to continue in 1947) by Wartime Housing Limited, the Veterans' Land Act Administration, Housing Enterprises Limited (a holding company set up by insurance companies in Canada), and builders operating under the Integrated Housing Plan (financed under the National Housing Act, 1944). Contractors and builders who will carry out these projects are expected to achieve some reduction in costs through bulk purchases of building materials and more efficient use of construction labour. Further, a certain degree of site assembly of materials with pre-cut parts coming from factories and of use of power machinery on the site will also help to reduce costs. Prefabricated houses are not likely to play an important role in the housing program of 1946 and 1947 but a number of units will probably be installed, further contributing to the lowering of the *average* cost per unit.

(d) Account has also to be taken of the regional variation of construction methods. For example, climatic conditions in the West permit houses to be

[1] *Housing Census, 1941*, Dominion Bureau of Statistics, Ottawa.
[2] *Housing and Community Planning*, Advisory Committee on Reconstruction, Ottawa, March, 1944, p. 328.

built without basements and with little or no insulation, while such methods are not common in Central Canada and the Maritimes. Standards of housing construction vary also as between different sized urban areas, urban and rural non-farm areas, frontier communities and farm areas. Thus in some instances, bathtubs might be replaced by showers, while in others, no modern bathing facilities may be installed because of the lack of running water.

While some of the factors cannot be assessed quantitatively, a careful appraisal, on the basis of available information, indicated that the average cost of the actual unit would likely be of the order of $5,500, or about 18 per cent below the cost of the average unit of a housing program of "desirable" standards. The fact has to be acknowledged, however, that there will be some tendency towards an increase in construction costs of the average unit. Some luxury homes are likely to be built and the possibility of a further rise of construction costs, both in the field of building materials and construction labour cannot be overlooked. However, the factors tending towards a reduction of the *average* cost per unit in a housing target of *actual* standards to a level below the *average* cost of a *desirable* standard unit are likely to be greater that the forces working in the opposite direction.

The classification of construction costs by major components, comprising outlay on building materials (including transportation costs to the site), on-site labour and overhead and profits of builders and contractors, was obtained by following the procedure outlined in the Note to Table 8.

Table 7.—Percentage Increase of Hourly Wage Rates for Selected Groups of Industries, of Wholesale Prices of Selected Commodities and of Costs of Living Index, Canada, 1939-1945

Hourly wage rates paid to workers in industry for 1939 were taken from *Wage Rates and Hours of Labour in Canada, 1943*, Department of Labour, Ottawa, 1945, pp. 7-8. Figures for 1944 were taken from the *Labour Gazette*, Department of Labour, Ottawa, October, 1945, p. 1425. Figures for 1945 are preliminary and were made available by courtesy of the Department of Labour.

Data on wholesale prices of selected commodities and the cost of living index for 1939 were taken from *Prices and Price Indexes, 1913-1943*, Dominion Bureau of Statistics, Ottawa, 1945, pp. 11, 38 and 58. The figures for 1945 were taken from Monthly Bulletin on *Prices and Price Indexes*, Dominion Bureau of Statistics, Ottawa, April, 1946, pp. 3, 5, 6 and 10.

Table 8.—Components of Construction Costs of One Housing Unit, by Types of Structures and Kinds of Building Materials Used

Material costs for the different types of housing units were arrived at by calculating all the individual items which go into the construction of an individual dwelling unit and multiplying these by an average price per unit of material as shown in Tables VI-XXII, Appendix B. (For sources and methods of computation, see Notes to Tables VI-XXII). On-site labour costs in all cases but the converted house were arrived at by using the result of a survey of the experiences of contractors and builders operating during eight years administration under the Dominion Housing Act, 1935, and the National Housing Act, 1938. This survey showed that cost of materials made up between 50 and 55 per cent of the total, wage payments to on-site labour between 35 and 40 per cent and overhead expenses and profits about 10 per cent.[1]

[1] *The Labour Value of the Building Dollar*, op. cit., p. 29. (The ratios actually used in this study were: materials—55 per cent, labour—35 per cent and overhead expenses and profits—10 per cent).

For the purpose of this study it was assumed that, on an average, on-site labour costs make up 37·5 per cent of total construction costs for all types of structures (except converted houses) with 52·5 per cent going into materials. Because of the existence of regional differentials in productivity, a median appeared to be preferable to either the lower or upper boundaries of the margins suggested in the survey. It bears emphasis, however, that in particular cases where substantial delays are caused because of material shortages or where efficiency of building labour is markedly low, wage payments may become almost as high as outlay for materials. The results obtained by using the above procedure were checked with construction costs of similar types of houses actually built and were found, with due allowance for deviation of local from national average prices and construction wage rates, to be close approximations.

On-site labour costs of a converted house were obtained from the National Housing Administration on the basis of an actual conversion job carried out under the provisions of the Housing Conversion Plan, 1943.[1]

Overhead and profits of builders and contractors were assumed to amount to not more than 10 per cent of the total cost. This is a reasonable proportion based on pre-war experience but does not hold good in all cases of war and post-war experiences. It appears that in some cases speculative builders have been charging a somewhat higher proportion of total cost for overhead and profits. But no account of such additional charges for housing construction has been taken in this study in arriving at the approximate expenditures required to attain a given housing target. In the case of the converted house, the contractor employed by the National Housing Administration was only responsible for part of the job. His fee was below 10 per cent of total outlay and it was raised to that level to allow for a cost factor for some of the organizing work done by the National Housing Administration itself.

The weighted average cost of housing units comprising the target was arrived at by applying the frequency distribution shown in Table I, Appendix B, to the component and total cost of the 17 different types of houses, then adding sub-totals and dividing the total by the number of units in the housing target.

Table 9.—Construction Costs per Room and Cubic Foot, by Types of Structures and Kinds of Building Materials Used

Construction costs per unit were taken from Table 8. Rooms and cubic feet per unit were computed from the blueprints of the 17 types of houses which served as the basis for estimating building material requirements. Construction costs per room and cubic foot were arrived at by dividing total cost per unit by the number of rooms and cubic feet. The weighted average of construction costs per room and cubic foot was arrived at by multiplying the respective items by the frequency distribution as shown in Table I, Appendix B and dividing the total by the number of rooms and cubic feet.

Table 10.—Estimated On-site and Off-site Manpower Requirements of Housing Target on the Basis of Desirable and Actual Standards

The total number of on-site man-hours was calculated by dividing total wage payments to on-site labour (see Table 6) by the average annual hourly wage rate paid to construction workers during 1945 (see Table V, Appendix B) slightly adjusted upward to allow for a likely increase in 1946. The number of off-site man-hours was arrived at by multiplying on-site man-hours provided by the construction of all types of houses except the converted house by a factor

[1] The Housing Conversion Plan started with an Order in Council (P.C. 2614), dated April 1, 1943, authorizing the Minister of Finance to lease suitable buildings in the Greater Ottawa area from their owners for a period of five years with the right of renewal for an additional three years and to convert them into multiple family units for the purpose of sub-letting. The average estimated cost of construction per unit was not to exceed $1,500. A further restriction was set by fixing the total amount to be spent on the conversion of houses in the city. The first Order in Council was followed by others making similar provisions (with some adjustments particularly with regard to construction costs) for a number of other cities.

of 1·32. This factor was obtained from a study of the employment content of houses constructed under eight years administration of the Dominion Housing Act, 1935, and the National Housing Act, 1938. In that study it was estimated that the construction of 25,085 housing units provided 57·4 million man-hours of work on the site and 75·6 million man-hours off the site, or a ratio of 1 : 1·32.[1]

It was not possible to use a conversion factor in arriving at an estimate of the off-site employment content of material purchases for housing conversion because the ratio of outlay for materials to wage payments varied from that shown for new houses. The following procedure was adopted. The total number of off-site man-hours and the value of building materials was computed for a program of 48,500 housing units, that is, the total target minus 1,500 converted units. Value of building materials was divided by the number of off-site man-hours to arrive at the value of the output per man-hour in the industries supplying building materials and transportation services.

Material costs as shown in Table 8 were multiplied by the number of converted houses as shown in Table I, Appendix B, and the result was divided by the value of output per man-hour arriving at an estimate of off-site man-hours provided by material purchases in housing conversion. This figure was added to the off-site man-hours provided by material purchases in new house-building construction giving the total off-site employment for the housing target varying in dimensions from 50,000 to 80,000 housing units.

Estimates of man-years of on-site employment were arrived at by dividing the total number of man-hours by 1,760. This figure was taken as the average number of man-hours worked during an on-site man-year equal to 40 working weeks[2] of 44 hours each. It was necessary to take a lower average than is customary in manufacturing industries because of seasonal and other factors.

The number of off-site man-years was arrived at by dividing the total number of off-site man-hours by 2,000. This figure is generally accepted as a standard average per year in the manufacturing and transportation industries. It is equal to 45·4 working weeks of 44 hours each. This figure is of necessity lower than the full working year of 52 weeks because of the need to allow for the time lost in changing jobs, illness, holidays, frictional unemployment, etc.[3]

Table 11.—Estimated On-site and Off-site Employment of One Housing Unit, by Types of Structures and Kinds of Building Materials Used

On-site man-hours for the different types of dwellings were arrived at by dividing on-site labour costs shown in Table 8 by the average annual hourly wage rate of construction workers paid during 1945 (shown in Table V, Appendix B), adjusted slightly upward to allow for wage increases in 1946. Off-site man-hours in all cases except in that of the converted house were arrived at by applying the factor of 1·32, referred to above, to on-site man-hours. In the case of the converted house, off-site man-hours were computed by use of the output per man-hour factor discussed in the previous section. Averages in the employment content of houses differing in type of structure and kind of building materials used are subject to the same qualifications referred to in the text (see Chapter III and Note to Table 8).

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[1] *The Labour Value of the Building Dollar*, op. cit., p. 36.

[2] The last Census indicated that the wage-earning construction worker (male) worked, on an average, 36·7 weeks during the year (June 2, 1940-June 2, 1941) preceding the taking of the Census (*Earnings and Employment*, Census Bulletin, No. E-2, Dominion Bureau of Statistics, Ottawa, 1941). The above figure understates somewhat the actual number of weeks worked during the year because it excludes work done by construction workers on their own account.

[3] In the 12 months' period (June 2, 1940-June 2, 1941) preceding the taking of the 1941 Census, wage-earners, in manufacturing industries worked, on an average, 42·7 weeks of 50·4 hours each, a total of 2,152 man-hours. With the abolition of overtime work, this number is likely to decline somewhat. The number of weeks worked is a weighted average based on the distribution of male and female wage-earners in the manufacturing industries (*Earnings and Employment*, Census Bulletin, No. E-2, Dominion Bureau of Statistics, Ottawa, 1941). The number of hours worked per week is a median of the average hours worked per week (including overtime) during a month of highest employment for 1940 and 1941. (*Weekly Earnings and Hours of Work of Male and Female Wage-earners Employed in the Manufacturing Industries of Canada*, Dominion Bureau of Statistics, Ottawa, 1943 and 1945).

Table 12.—Value and Distribution of Building Material Requirements of Housing Target, on the Basis of Desirable and Actual Standards, by Nine Major Classifications

Value of building materials for a housing target of "desirable" standards is a summation of the sub-totals shown for nine major industries in Tables 13-16. Grouping of building materials into nine major classifications for a housing target of "actual" standards was arrived at by applying the percentage distribution obtained from the "desirable" standard target to the total expenditures on building materials under the "actual" standard target varying in dimensions from 50,000 to 80,000 units.

Tables 13-16.—Value and Units of Building Material Requirements of a 50,000-80,000 Unit Housing Target, by Sixty-three Detailed Classifications

Building material requirements in units of material and value as shown in Tables VI-XXII were multiplied by the frequency distribution as shown in Table I, Appendix B, to arrive at material requirements of a housing target varying in dimensions from 50,000 to 80,000 units.

Average cost per unit of materials is a weighted average and was arrived at by dividing total value by total units of material required. For this reason, it differs from the figures on average cost per unit of materials as shown in Tables VI-XXII.

TABLES IN APPENDIX B

Table I.—Distribution of Housing Target, by Types of Structures and Kinds of Building Materials Used

The frequency distribution shown in this table and applied to a housing target varying in dimensions between 50,000 and 80,000 units was based on a sample of applications for construction licences approved by the Controller of Construction of the Department of Munitions and Supply. The coverage of the sample is described in Note to Table 3, Appendix A.

Table II.—New Housing Units Built by Urban and Rural Areas, Canada, 1945

The number of housing units built in urban and rural areas in Canada during 1945 was obtained from *Housing Statistics 1945, Dwelling Units—Type of Buildings and Types of Construction,* Dominion Bureau of Statistics, Ottawa, 1946; *Supplement to Housing Statistics 1945, Dwelling Units—Types of Buildings and Types of Construction for Individual Municipalities and Other Areas,* Dominion Bureau of Statistics, Ottawa, May, 1946; *Housing Statistics 1946, Dwelling Units and Type of Buildings Reported by Municipalities for Four Months Ending April 30, 1946,* Dominion Bureau of Statistics, Ottawa, April, 1946.

Table III.—Building Permits Issued for New[1] Housing Units, as Reported by 204 Municipalities, Canada, 1942-1945

The number of new[1] housing units for which building permits were issued, as reported by 204 municipalities in Canada during the years 1942, 1943, 1944 and 1945 was made available by courtesy of the Construction Branch, Dominion Bureau of Statistics. Revisions which supersede published material were included.

Table IV.—Indices of Wage Rates in the Construction Industry and Wholesale Prices of Building Materials During Two World Wars and Reconversion Periods

Indices of wage rates in the construction industry were obtained from *Wage Rates and Hours of Labour in Canada,* 1943, Department of Labour, Ottawa, 1945, p. 10; figures for 1944 obtained from *The Labour Gazette,* Department of Labour, Ottawa, October, 1945, p. 1425; preliminary figure for 1945, by courtesy of the Department of Labour. Indices of wholesale prices of building materials were obtained from *Prices and Price Indexes,* 1913-1943, Dominion Bureau of Statistics, Ottawa, 1945, p. 38; figure for 1944 obtained from *Prices and Price Indexes,* Dominion Bureau of Statistics, Ottawa, March, 1945, p. 3; figure for 1945 obtained from *Prices and Price Indexes,* Dominion Bureau of Statistics, Ottawa, April, 1946, p. 3.

Table V.—Average Annual Wage Rates and Indices of Wage Rates in the Construction Industry and Wholesale Prices of Building Materials, 1919-1945

Indices of wage rates in the construction industry were obtained from *Wage Rates and Hours of Labour in Canada,* 1943, Department of Labour, Ottawa, 1945, p. 10; figure for 1944 obtained from *The Labour Gazette,* Department of

[1] Includes additional units created by conversions.

Labour, Ottawa, October, 1945, p. 1425; preliminary figure for 1945, by courtesy of the Department of Labour. Data on average annual hourly wage rates in the construction industry were made available by courtesy of the Department of Labour. Indices of wholesale prices of building materials were obtained from *Prices and Price Indexes*, 1913-1943, Dominion Bureau of Statistics, Ottawa, 1945, p. 38; figure for 1944 obtained from *Prices and Price Indexes*, Dominion Bureau of Statistics, Ottawa, March, 1945, p. 3 and figure for 1945 obtained from *Prices and Price Indexes*, Dominion Bureau of Statistics, Ottawa, April, 1946, p. 3.

Tables VI-XXII.—Estimated Building Material Requirements of One Dwelling Unit for 17 Different Types

The estimates of building material requirements for 16 types of new housing units were prepared by the Chief Technical Director, Construction Control, Department of Munitions and Supply, assisted by a technical officer of the Chief Architect's Branch, Department of Public Works, using representative submissions made to the Department of Munitions and Supply. The estimates submitted by applicants were carefully appraised on the basis of floor plans, available information on construction practices in the various localities, efficiency and availability of labour, prices of building materials, wages paid to construction labour and customary remuneration of builders for their managerial efforts. Prices of building materials were checked with information available on this subject in the various regional offices of the Wartime Prices and Trade Board. Final estimates both of unit requirements of materials and costs were discussed with a number of experienced builders who passed judgment on the representativeness of the estimates shown here.

The estimates on material requirements of a converted house have been supplied by the National Housing Administration of the Department of Finance, based on the records of a project completed by the Administration. The prices of materials given in these estimates were adjusted to conform to the prices for the country as a whole as used in the other 16 tables.

It bears emphasis that the cost per unit of materials used in the estimated building material requirements, Tables VI-XXII, represent what is considered to be an *average cost of materials throughout Canada* (for the first half of 1946) and should be interpreted in the light of conditions of cost and availability of materials in the vicinity of the construction site together with the effect of relative by-laws. Prices are based on retail sales with some adjustment for bulk purchasing in the case of large apartments or row houses.

In single, multiple and row houses, values shown per dwelling unit are computed on the assumption that the contractor undertakes to build only a small number of structures at a time. Large-scale building projects would involve a lowering of costs; hence values per dwelling unit, if built efficiently, would be somewhat lower than those indicated in the study.

Material requirements and values in the multiple, row and apartment houses were estimated, in the first instance, for the structure as a whole and hence calculated to the nearest "five"—following the general practice of the trade. To arrive at requirements and values per dwelling unit, the estimates so obtained were divided by the average number of units applicable to each type and the results shown as computed.

Some explanatory notes on items which are not self-evident in the tabular material are given below, following the order of items as listed in the tables.

EXPLANATORY NOTES

I. Cement, Gravel and Sand:

(1) and (2) Cement and aggregates for concrete are for footings and foundation walls and piers, exterior cement finish for foundation walls above grade and for 4″ thick basement floor slab. The thickness for foundation walls in all types is 10″, except in type G which is 12″. The proportions of materials taken are (1 : 2 : 4); one cement to two fine aggregate and four coarse aggregate. The weight of one bag of cement is taken at 87·5 lbs. with four bags to a barrel of 350 lbs.

(3) Concrete masonry blocks when manufactured and built to comply with local by-laws might be used for foundation walls instead of poured concrete.

II. Brick, Tile and Stone:

(4) Brick for Chimneys: The unit cost of brick includes mortar materials and allows for a proportion of 15 per cent "face" brick for exposed exterior part of chimney, the remainder being of "backer" (common) brick. In the apartment house, the unit cost of brick ($30 per M) is higher than in single, multiple or row houses ($26 per M) because face brick of slightly higher grade is used.

(5) Brick for Exterior Walls: The $33 per M unit cost of brick is based upon an assumed average cost of brick produced throughout the country of $30 per M, with an allowance for mortar materials and lintels—the range of cost of brick per M being between $21 and $35.50. It is considered that in certain areas where freight charges make the use of the higher grade brick prohibitive, a locally made brick of suitable character would be used for facing. In the Toronto area where solid masonry wall construction is required by by-laws, the cost of brick for two-brick-thick wall construction would be of the order of $35.50 per M for face brick and $22 per M for common brick. In certain districts, sand-lime brick and concrete brick or block would be used for backing. In Montreal and Quebec and in the Maritimes the average cost would be within the $33 unit price.

It bears emphasis that the price of $33 per M is based on a weighted average taking account of the different quantities of face and common brick used in housing construction.

(6) Stone Facing: Unit cost per square yard is for masonry veneer known as "crazy" (rubble) work, which is of a random nature and produces an irregular appearance and in which irregular small quarry stone is used, about 6″ on the bed. The cost includes sills, arches, and lintels and mortar materials. This class of work is restricted to certain areas where stone is readily available.

(7) Field tile sub-drainage comprises 4″ agricultural clay tile. The quantities include a line of tile around the exterior of all foundation wall footings, with a branch under the basement floor and having weepers to a sump hole away from the building.

(8) Vitrified flue linings for two flues per chimney are $8\frac{1}{2}'' \times 8\frac{1}{2}''$ in size and are mandatory under building by-laws. However, in case of shortages of vitrified flue linings, the thickness of brick work could be increased to conform to building by-laws.

III. Lumber and Its Products:

(9) Structural (dimension) lumber comprises timber for exterior wall framing, floor and ceiling joists, roof members, built up beams, and interior partition studding. In the estimates an allowance is made for waste which might occur when any lumber is used in the formwork of foundation walls and then re-used. Allowance is also made for general waste in cutting and additional waste occurring where standard mill lengths are not usable.

In houses of Types A, B and C, the exterior wall in each case is framed of timber, the unit cost of which is $65 per M. This is based upon an average of British Columbia, Ontario, and Maritime prices, for dimensions ranging from $2'' \times 4''$ to $2'' \times 10''$.

For houses of Types D, E, F, and G where exterior walls are of masonry, in which $2'' \times 4''$ timbers are not used, the unit cost of $75 per M is based upon an average of Ontario and Maritime prices, in which districts (also Quebec) these types of construction are more common. In other words, these solid wall types of construction are not typical for the area of cheap lumber. In British Columbia, for example, the *unit* cost of lumber would be lower.

(10) Yard lumber consists of nominal thickness boarding for inner and outer sheathing of wood framed exterior walls, also for roofing and under-flooring. The quantities include form lumber, re-used, with an allowance for relative waste and also for general waste.

The unit cost of $60 per M is based upon an average of British Columbia and Eastern prices except for houses of Types D, E, F, and G, more typical of Eastern Canada, where the non-availability of cheaper lumber from British Columbia warrants the higher unit cost of $70 per M.

In certain districts where building by-laws permit and when freight charges from source of manufacture do not make its use prohibitive, one of the undernoted alternative materials would be an economical substitution for outer and inner lumber sheathing of exterior timber framed walls, viz.—

(a) $\frac{5}{8}$″ thick triple strength, laminated, fibre board.

(b) $\frac{1}{2}$″ thick gypsum board sheathing (24″ × 8′0″).

(11) Wood Clapboard for Exterior Walls: The term clapboard includes the various standard exterior finish boardings known respectively as "Drop siding", "Rustics", "Bevel siding", also "Cove match and shiplap", and "Double clapboard—match and shiplap."

The unit cost of 10c. per square foot allows for $\frac{13}{16}$″ thick lumber (1″ thick nominal), British Columbia standard $\frac{1}{2}$ inch thick "bevel siding" not being suitable in certain districts. The cost is based upon an average of Western and Eastern prices, in the relative species produced.

Alternatives to wood clapboard would be *(a)* cement asbestos siding shingles which in certain districts could be obtained on a favourable competitive basis, *(b)* wood shingles, and *(c)* imitation brick siding.

(12) Exterior Millwork: Doors, windows, porch frames, cornices:

(a) Less exterior millwork is used in houses of Types A, B, C and D than in Types E, F and G.

(b) Types E, F and G houses have thicker doors and more material; hence the difference in value for exterior millwork between these types and Types A, B, C and D.

(13) Flooring—Hardwood: The unit cost covers birch and maple species of No. 2 grade in $\frac{1}{2}$″ and$\frac{13}{16}$″ thickness, with a range in prices of $107, $115, $120, and $152 per M; the unit price of $135 for $\frac{13}{16}$″ thick maple in Ontario is used. In single houses, hardwood flooring has been allowed for the first floor only.

(14) Flooring—Softwood: Unit cost is based on range of prices from $55 in British Columbia to $77 in Ontario, for 1″ × 4″ nominal tongued and grooved flat grain British Columbia fir or Eastern white pine No. 1 and No. 2 common grade. In single houses, softwood flooring has been allowed for the second floor only.

(15) Interior Millwork: Doors, doors and windows trim, baseboards, cupboards, etc. Unit cost is based upon minimum standard details out of minimum stock size materials.

(17) Strapping (or Furring): The unit cost allows for small quantities—2″ × 1″.

In the apartment house, Type E, the cubic foot content which includes 14,000 cu. ft. for a garage and boiler room reflects on all unit estimates (quantities and values) of lumber (as well as of other material requirements). Hence quantities and values are not comparable with those for the multiple unit house, Type E.
All quantities for lumber items (9-17, inclusive) allow for waste.

IV. Lath, Plaster and Insulation Materials:

(18) Insulating Materials—Rock Wool: The unit price is for 3″ standard full thick batts and is based upon less than carload lots, east of Fort William. In houses of Types A, B and C, the quantities include insulation for the exterior walls and upper ceiling; in Types D, E, F and G houses, the quantities include insulation for the upper ceiling only. Alternative insulating materials would be "Bark Wool" as produced on the West Coast, or "Insulating Board" of wood fibre.

(19) Interior Plaster: The unit cost is based upon the use of standard 16″ × 48″ gypsum lath $\frac{3}{8}$″ thick; alternatives would be standard size 16″ × 48″ fibre lath $\frac{1}{2}$″ thick (i.e., insulating lath) or wood lath. On occasion, 1″ thick standard size fibre lath or insulating lath is used as a plaster base. Under certain climatic conditions it serves as a substitute of or as a complement to rock wool insulation.

(20) Building Paper—Inside: The unit cost is for a N.H.A. approved vapour seal, 500 square feet per roll, asphalt saturated kraft paper, and the quantities cover the application of same to inner surfaces of exterior frame walls and to the top of under-flooring.

(21) Building Paper—Outside: The unit cost is for a standard asphalt or tar saturated rag felt of 12 lbs. weight, with 432 square feet per roll weighing 52 lbs., and the quantities cover the application to the outer surfaces of exterior frame walls.

(22) Exterior Plaster—Stucco: The unit price for stucco materials on a Type C house of wood frame is based upon the price of Portland cement plaster on wire mesh or expanded metal lath.

The unit price of stucco materials on a Type D house of masonry blocks and stucco and on a Type G house of masonry blocks with part stone facing and part stucco is for Portland cement plaster applied directly to the blocks.

V. Roofing Materials:

(23) Roofing—Shingles: The unit price covers asphalt shingles, 210 pounds weight per square, east of Winnipeg and wood shingles west of Winnipeg.

Cement asbestos rigid shingles would be an alternative roofing in areas where their use would not be prohibitive due to freight charges from point of manufacture.

VI. Paint and Glass:

(28) Glass: In single, multiple and row houses of all types no allowance is made for winter sash and hence for glass required in winter sash. The unit cost per sq. ft. of glass (with allowance for wastage) for these structures is for standard lights (star glass) and includes the cost of putty or glazing compound.

In the apartment house, Type E, allowance is made for winter sash and hence for glass required in winter sash. Windows for the apartment house include two panes of glass approximately 2′ 6″ × 3′ each. The unit cost per sq. ft. (with allowance for wastage) is for double diamond lights and includes the cost of putty or glazing compound.

(30) Paint—Inside: The unit price is for oil paint; an alternative would be Casein water-mixed paint in two coats, the material price of which would reduce the cost.

VII. Plumbing and Heating Equipment and Fixtures:

(33 to 39) Plumbing: The unit cost per foot of plumbing pipe includes fittings, traps, clean-outs, roof flanges, etc., and caulking lead, etc. 2″ cast iron soil pipe when available might be used as a substitute for 2″ steel pipe. Plumbing ½″ galvanized steel water pipe could be replaced as an alternative with ½″ streamline (M) copper tubing.

(40) Plumbing ¾″ lead pipe water service could be replaced as an alternative by ¾″ streamline (K) copper tubing or ¾″ wrought iron pipe covered with exterior bitumastic.

(46) Toilets: The unit cost is for closet bowl, tank and seat, complete.

(47) Wash Basins: The unit cost is for 18″ × 20″ china wall hung lavatory, complete.

(48) Bathtubs: The unit cost of $80 is for a 5′ 0″ cast iron enamel recess bath complete for installation in single, multiple, and converted houses of all types. If shower fixture, shower curtain rod and curtain are included, an additional sum of $15 is necessary. (If bathtub is omitted and shower stall with shower head and pan substituted, the unit cost would be $40).

(49) Combination Tub and Sink (for kitchen): The unit cost is for one cast iron enamelled sink and laundry tray complete with faucet, trap and hardwood drainboard.

(50) Domestic Hot Water Heater: The unit cost of $30 (except for the apartment house) includes one—No. 1 W.K. tank heater, 40 gallon capacity (jacket: coal) or equivalent, in combination with one No. 30-22 Imp. gal. (30 U.S. gal.) galvanized range boiler (or tank) and stand capable of providing hot water to one bathroom and one kitchen.

Alternatives: Instead of using a jacket heater costing $14, an alternative means of producing hot water would be:

(1) Insertion in the warm air furnace of a domestic, cast iron, ring heater, 10″ in diameter, costing about $3, or

(2) Insertion in the range boiler (or tank) of an electric water heater—insert type—costing about $12.

(51) Vitrified Clay Sewer Drain: The unit cost is for 6″ sewer pipe in straight runs.

In certain districts, concrete sewer pipe or fibre drain pipe could be substituted, provided its use met the requirements of authorities having jurisdiction. It should be noted that for all types of structures in this study, water, sewer and drain services are taken to be in reasonable proximity to the project.

(52) Smoke Pipes and Warm Air Ducts: These are of galvanized sheet steel of No. 26 gauge for smoke pipes, and No. 28 gauge for ducts. The unit price includes grilles and insulation.

VIII. Electrical Equipment and Fixtures:

(53) Electrical Wiring: The cost includes entrance switch, single pole switches, 6 circuit combination panel, No. 4 wire, 14/2 Romex, receptacles, outlet boxes, conduit, fuses, etc.

IX. Other Materials:

(55) Metal Window Balances: The unit cost allows for metal window balances for both the upper and lower sashes.

(57) and (58) Sheet Metal Eavestroughs and Down Spouts: No. 28 gauge galvanized sheet metal of standard shapes. The unit price includes accessories.

(59) Sheet Metal Roof Flashings: No. 26 gauge galvanized sheet metal. Unit cost is for small quantities.

(60) Rough hardware comprises mainly nails. Quantities allow for a reasonable amount of wastage. One hundred lbs. of nails are taken to constitute a keg.

(62) Damp Proofing: The cost allows for two coats of bituminous damp-proof coating on the inner surfaces of exterior masonry walls above grade level, in houses of Types D, E, F and G.

CHARTS IN THE TEXT

Figure 1.—Housing Target by Types of Structures and Building Materials Used
For sources, see Notes to Tables 1 and 3.

Figure 2.—New Housing Units Built, Canada, 1945
For sources, see Note to Table II.

Figure 3.—Construction Costs of Housing Target (Actual Standards), Major Components
For sources, see Note to Table 6.

Figure 4.—Increases of Wage Rates, Wholesale Prices and Cost of Living, Canada, 1939-1945
For sources, see Note to Table 7.

Figure 5.—Construction Costs During Two World Wars and Reconversion Periods
For sources, see Note to Table IV.

Figure 6.—Components of Construction Costs of One Housing Unit by Types of Structures and Building Materials Used
For sources, see Note to Table 8.

Figure 7.—Total Employment Provided by Housing Target (Actual Standards)
For sources, see Note to Table 10.

Figure 8.—Share of Construction Costs Going to Industries Supplying Building Materials for Housing Target (Actual Standards)
For sources, see Note to Table 12.

SCHEDULE IN THE TEXT

Schedule A.—Grouping of Major Components of Construction Costs
Schedule A was prepared in consultation with the Chief Technical Director, Construction Control, Department of Munitions and Supply.

APPENDIX B

Supplementary Statistical Tables

APPENDIX B. SUPPLEMENTARY STATISTICAL TABLES

TABLE I.—DISTRIBUTION OF HOUSING TARGET, BY TYPES OF STRUCTURES AND KINDS OF BUILDING MATERIALS USED

Code	Type of structure and kind of building material used	Percentage distribution	Housing target			
			50,000 units	60,000 units	70,000 units	80,000 units
	I. *Single house*—					
A	Wood frame with wood clapboard....	41·87	20,935	25,122	29,309	33,496
B	Wood frame and brick veneer.....	11·06	5,530	6,636	7,742	8,848
C	Wood frame with stucco on lath.....	11·85	5,925	7,110	8,295	9,480
D	Concrete masonry blocks and stucco..	4·74	2,370	2,844	3,318	3,792
E	Solid masonry: brick facing and masonry blocks.....	3·16	1,580	1,896	2,212	2,528
F	Solid brick.....	4·74	2,370	2,844	3,318	3,792
G	Solid masonry: masonry blocks with part stone facing and part stucco...	1·58	790	948	1,106	1,264
	Sub-total.....	79·00	39,500	47,400	55,300	63,200
	II. *Multiple unit house*—					
A	Wood frame with wood clapboard.....	4·80	2,400	2,880	3,360	3,840
B	Wood frame and brick veneer.....	5·25	2,625	3,150	3,675	4,200
C	Wood frame with stucco on lath.....	·30	150	180	210	240
D	Concrete masonry blocks and stucco..	1·50	750	900	1,050	1,200
E	Solid masonry: brick facing and masonry blocks.....	·90	450	540	630	720
F	Solid brick.....	2·10	1,050	1,260	1,470	1,680
G	Solid masonry: masonry blocks with part stone facing and part stucco....	·15	75	90	105	120
	Sub-total.....	15·00	7,500	9,000	10,500	12,000
	III. *Row and apartment house*—					
B	Wood frame and brick veneer.....	1·14	570	684	798	912
E	Solid masonry: brick facing and masonry blocks.....	1·86	930	1,116	1,302	1,488
	Sub-total.....	3·00	1,500	1,800	2,100	2,400
	IV. *Converted house*—					
B	Wood frame and brick veneer.....	3·00	1,500	1,800	2,100	2,400
—	Total.....	100·00	50,000	60,000	70,000	80,000

Source: See Appendix A.

TABLE II.—NEW HOUSING UNITS BUILT BY URBAN AND RURAL AREAS, CANADA, 1945

Urban community or area	Number of units	Proportion of total	Urban community or area	Number of units	Proportion of total
Montreal[1]	4,797	10·05	St-Jean	108	·23
Toronto[1]	3,533	7·41	Granby	106	·22
Vancouver[1]	2,875	6·03	Cornwall	105	·22
Ottawa[1]	1,497	3·14	Belleville	104	·22
Winnipeg[1]	1,259	2·64	Valleyfield	104	·22
Québec[1]	1,054	2·21	Medicine Hat	102	·21
Windsor[1]	747	1·57	Chilliwack	101	·21
Calgary	707	1·48	Sydney	90	·19
Edmonton	662	1·39	Victoriaville	89	·19
Victoria[1]	650	1·36	Ste-Agathe-des-Monts	83	·17
Hamilton[1]	613	1·28	Magog	80	·17
London[1]	446	·93	Chicoutimi	79	·17
Saskatoon	416	·87	Vernon	79	·17
Sherbrooke	324	·68	Brandon	79	·17
Three Rivers	311	·65	Moncton	78	·16
Moose Jaw	289	·61	Grand'Mère	75	·16
Regina	245	·51	Drummondville	74	·16
Lethbridge	239	·50	Sarnia	74	·16
Port Arthur	234	·49	Cap-de-la-Madeleine	74	·16
Kitchener	233	·49	Barrie	71	·15
Ft. William	225	·47	Mégantic	71	·15
Sudbury	197	·41	Pembroke	67	·14
Halifax[1]	189	·40	Edmundston	66	·14
Brantford	182	·38	Val d'Or	66	·14
Chatham	172	·36	Flin Flon	61	·13
St-Jérôme	165	·35	Joliette	60	·13
Saint John[1]	163	·34	Port Alberni	59	·12
Peterborough	161	·34	Iberville	59	·12
Shawinigan Falls	157	·33	Brampton	58	·12
St. Catharines	151	·32	Rimouski	58	·12
Oshawa	143	·30	Orillia	57	·12
Kingston	136	·29	Waterloo	57	·12
St-Hyacinthe	120	·25	Galt	56	·12
Sault Ste. Marie	115	·24	Estevan	54	·11
Glace Bay	111	·23	Swift Current	50	.10
Prince Albert	109	·23	Sub-total	26,281	55·08
Summary—					
Urban communities reporting 50 or more units				26,281	55·08
Urban communities with less than 50 units[2]				8,233	17·26
Total urban[3]				34,514	72·34
Total rural[4]				13,197	27·66
Total Canada[5]				47,711	100·00

Source: See Appendix A.

(1) Figures relate to metropolitan areas, including some rural municipalities.
(2) Includes urban communities not reporting for which estimates have been made.
(3) Includes some rural municipalities forming parts of metropolitan areas.
(4) Includes unorganized areas, the Northwest Territories and the Yukon.
(5) Includes conversions.

TABLE III.—BUILDING PERMITS ISSUED FOR NEW HOUSING UNITS, AS REPORTED BY 204 MUNICIPALITIES, CANADA, 1942-1945

Municipalities	Number of housing units[1]			
	1942	1943	1944	1945
Prince Edward Island—				
Charlottetown	7	8	7	28
Nova Scotia—				
Amherst	13	2	21	21
Bridgewater	5	1	5	13
Dartmouth	44	21	21	63
Glace Bay	49	37	66	103
Halifax	134	71	122	132
Liverpool	12	4	5	13
Lunenburg	— [2]	— [2]	— [2]	— [2]
New Glasgow	23	12	27	27
New Waterford	15	11	28	32
North Sydney	2	8	10	23
Sydney	91	65	91	114
Sydney Mines	4	4	14	27
Truro	10	10	27	51
Yarmouth	3	3	4	17
New Brunswick—				
Campbellton	3	7	7	19
Chatham	2	— [4]	1	2[3]
Dalhousie	3	— [4]	2	— [4]
Fredericton	7	1	12	25
Moncton	44	43	73	96
Newcastle	2	7	7	3
Saint John	28	32	35	27
St. Stephen	— [4]	— [4]	2	12
Quebec—				
Cap-de-la-Madeleine	67	26	74	106
Chicoutimi	76	59	166	68
Coaticook	— [4]	1	14	20
Drummondville	18	35	93	55
Granby	31	37	73	79
Grand'Mere	13	9	33	39
Hampstead	14	3	98	43
Hull	80	25	145	207
Iberville	29	2	14	40
Joliette	25	53	64	92
Jonquiere	150	90	65	34
Lachine	54	51	93	124
Laprairie	1	8	13	16
La Tuque	13	17	38	17
Levis	20	25	46	52
Longueuil	71	35	71	95
Megantic	15	4	9	38
Montreal (Maisonneuve)	1,577	1,393	3,601	3,053
Montreal East	1	3	6	24
Montreal North	31	42	137	166
Montreal West	— [2]	1	3	5
Mount Royal	68	165	310	102
Noranda	3	1	1	40
Outremont	32	46	30	47
Pointe-aux-Trembles	29	36	70	91
Pointe Claire	9	12	38	33
Quebec	150	249	988	707
Rimouski	22	12	48	48
Riviere du Loup	5	2	11	5
Rouyn	11	— [4]	22	7
Ste-Agathe-des-Monts	8	6	31	35
Ste-Anne-de-Bellevue	5	5	11	6
St-Hyacinthe	9	18	97	107
St-Jean	27	35	130	83
St-Jerome	86	71	141	131
St-Joseph-de-Grantham	2	— [4]	14	25
St-Lambert	11	15	26	41
St-Laurent	33	51	30	48
Shawinigan Falls	133	137	239	156

Footnotes at the end of table, p. 96.

TABLE III.—BUILDING PERMITS ISSUED FOR NEW HOUSING UNITS, AS REPORTED BY 204 MUNICIPALITIES, CANADA, 1942-1945—*Continued*

Municipalities	Number of housing units[1]			
	1942	1943	1944	1945
Quebec—(continued)—				
Sherbrooke	96	155	270	331
Sorel	43	36	36	25
Trois-Rivieres	43	19	127	192
Val d'Or	2	— [4]	14	34
Valleyfield	64	56	90	110
Verdun	381	195	240	336
Westmount	14	12	45	62
Ontario—				
Amherstburg	6	3	10	25
Barrie	27	26	45	60
Belleville	54	37	55	83
Bowmanville	1	1	3	9
Bracebridge	2	2	3	6
Brampton	24	9	17	37
Brantford	22	48	70	95
Brockville	5	14	17	25
Burlington	23	13	51	49
Campbellford	— [4]	— [2]	2	12
Chatham	22	13	35	87
Cobourg	2	1	7	12
Cochrane	1	2	1	5
Collingwood	5	3	7	4
Cornwall	33	32	56	96
Dundas	3	10	10	17
Eastview	21	38	51	68
East York Twp	521	369	366	448
Etobicoke Twp	310	212	310	641
Forest Hill	71	67	171	161
Fort Erie	9	3	10	7
Fort Frances	6	2	2	33
Fort William	158	83	153	229
Galt	75	14	42	77
Gananoque	7	9	5	20
Gloucester Twp	29	19	76	123
Goderich	7	5	3	8
Guelph	15	27	47	46
Haileybury	— [2]	— [2]	— [2]	3
Hamilton	290	356	998	389
Hanover	4	4	4	4
Hawkesbury	4	3	1	9
Huntsville	10	2	7	18
Ingersoll	1	2	6	10
Kapuskasing	2	1	50	34
Kenora	11	3	9	22
Kingston	97	91	118	124
Kirkland Lake (Twp. of Teck)	— [4]	— [2]	3	9
Kitchener	103	151	219	195
Leamington	9	20	10	35
Leaside	211	208	236	277
Lindsay	7	1	6	19
Listowel	— [2]	— [2]	1	3
London	134	186	271	280
Long Branch	14	6	38	88
Mimico	93	84	88	50
Napanee	— [4]	— [4]	4	5
New Liskeard	6	4	2	5
Newmarket	3	2	9	9
New Toronto	33	35	53	34
Niagara Falls	24	19	45	68
North Bay	7	3	26	41
North York Twp	385	231	355	756
Oakville	15	9	18	42
Orillia	17	21	36	56
Oshawa	66	79	142	163
Ottawa	273	520	510	430
Owen Sound	24	17	25	92
Paris	2	2	5	7

Footnotes at the end of table, p. 96.

TABLE III.—BUILDING PERMITS ISSUED FOR NEW HOUSING UNITS, AS REPORTED BY 204 MUNICIPALITIES, CANADA, 1942-1945—*Continued*

Municipalities	Number of housing units[1]			
	1942	1943	1944	1945
Ontario—(continued)—				
Parry Sound	20	2	1	5
Pembroke	22	15	42	57
Perth	—[2]	2	2	7
Peterborough	62	47	89	134
Petrolia	—[2]	—[2]	—[2]	—[2]
Port Arthur	204	69	138	214
Port Colborne	14	8	26	25
Preston	18	14	3	19
Renfrew	5	3	17	29
Riverside	33	30	44	103
St. Catharines	183	163	113	199
St. Mary's	—[2]	1	—[2]	1
St. Thomas	22	16	30	26
Sarnia	77	292	135	248
Sault Ste. Marie	110	52	72	99
Scarboro Twp	182	172	255	505
Simcoe	5	1	18	24
Smith's Falls	1	2	2	11
Stratford	2	2	3	19
Sudbury	122	121	208	196
Swansea	14	22	12	25
Tillsonburg	4	3	9	28
Timmins	5	—[2]	12	29
Toronto	374	609	527	394
Trenton	9	8	26	15
Wallaceburg	3	3	7	4
Waterloo	24	34	43	57
Welland	47	19	37	31
Weston	56	36	41	38
Whitby	19	13	15	23
Windsor	1,371	98	421	165
Woodstock	18	24	33	57
York Twp	349	446	387	472
Manitoba—				
Brandon	32	15	34	53
Brooklands	10	4	20	26
Dauphin	34	9	32	19
North Kildonan	30	7	32	45
Portage La Prairie	12	5	41	14
St. Boniface	89	69	170	354
Selkirk	13	10	12	21
The Pas	—[2]	4	4	—[2]
Transcona	9	10	10	35
Winnipeg	415	362	624	1,374
Saskatchewan—				
Biggar	—[2]	5	—[2]	2
Estevan	13	5	10	46
Melville	6	1	6	19
Moose Jaw	16	9	26	238
North Battleford	20	18	18	45
Prince Albert	66	24	179	137
Regina	85	77	161	417
Saskatoon	17	13	84	457
Swift Current	33	20	32	57
Weyburn	6	—[2]	4	16
Yorkton	26	16	10	31
Alberta—				
Calgary	451	303	714	1,284
Drumheller	2	3	4	9
Edmonton	500	894	1,099	1,851
Lethbridge	90	48	104	281
Medicine Hat	67	89	124	88

Footnotes at the end of table, p. 96.

TABLE III.—BUILDING PERMITS ISSUED FOR NEW HOUSING UNITS, AS REPORTED BY 204 MUNICIPALITIES, CANADA, 1942-1945—*Continued*

Municipalities	Number of housing units[1]			
	1942	1943	1944	1945
British Columbia—				
Chilliwack	25	6	76	101
Cranbrook	4	8	2	11
Fernie	— [2]	— [2]	1	1
Kamloops	5	6	25	68
Kelowna	28	8	89	174
Nanaimo	8	— [2]	13	42
Nelson	3	4	6	27
New Westminster	63	111	233	204
North Vancouver	535	115	110	74
Prince George	23	34	45	20
Prince Rupert	31	93	10	13
Revelstoke	7	— [2]	4	7
Rossland	1	— [4]	1	1
Trail	10	1	6	10
Vancouver	1,200	1,546	3,004	3,238
Vernon	25	17	33	69
Victoria	165	165	293	542
Total 204 Municipalities[5]	14,927	13,183	23,695	28,563[3]

Source: See Appendix A.

[1] Includes additional units created by conversions.
[2] No permits issued for housing units.
[3] Revised.
[4] No report.
[5] On the basis of the 1941 Census, the 204 municipalities comprised a population of 5,260,653 or 45·7 per cent of the total population in Canada.

TABLE IV.—INDICES OF WAGE RATES IN THE CONSTRUCTION INDUSTRY AND WHOLESALE PRICES OF BUILDING MATERIALS DURING TWO WORLD WARS AND RECONVERSION PERIODS

(Bases of indices: 1913 = 100 and 1939 = 100)

Year	Wage rates in the construction industry	Wholesale prices of building materials
World War I and Reconversion Period—		
1913	100·0	100·0
1914	100·8	93·7
1915	101·5	90·3
1916	102·5	103·7
1917	109·9	130·4
1918	126·0	158·3
1919	148·3	175·8
1920	181·0	214·9
World War II and Commencement of Reconversion Period—		
1939	100·0	100·0
1940	104·5	106·7
1941	111·6	119·7
1942	118·6	128·5
1943	127·7	135·2
1944	129·6	142·0
1945	131·1[1]	142·0[2]

Source: See Appendix A.

[1] Preliminary.
[2] A special investigation was made by the Prices Branch of the Dominion Bureau of Statistics to examine the reasons for the index of wholesale prices of building materials yielding the same results in 1945 as in 1944. The inquiry showed that wholesale prices of a number of building materials rose during 1945 while at the same time wholesale prices of selected items declined as a result of the removal of the sales tax and the War Exchange Conservation tax. Hence resultant decreases offset increases and the index remained at the 1944 level. The index does not take account of changes of retail prices or deterioration of quality.

TABLE V.—AVERAGE ANNUAL WAGE RATES AND INDICES OF WAGE RATES IN THE CONSTRUCTION INDUSTRY AND WHOLESALE PRICES OF BUILDING MATERIALS, 1919-1945

(Base of index: 1935–1939 = 100)

Year	Average annual hourly wage rate in the construction industry (cents)	Indices	
		Wage rates in the construction industry	Wholesale prices of building materials
1919	62·4	89·7	134·0
1920	76·2	109·5	163·8
1921	71·8	103·2	139·6
1922	68·6	98·4	123·7
1923	70·1	100·7	127·3
1924	71·5	102·7	121·3
1925	71·8	103·1	117·1
1926	72·5	104·2	113·8
1927	75·5	108·5	109·3
1928	78·2	112·3	110·8
1929	83·2	119·6	112·6
1930	85·6	123·0	103·3
1931	82·5	118·5	93·2
1932	75·2	107·9	87·8
1933	66·5	95·6	89·1
1934	65·2	93·7	93·9
1935	67·3	96·7	92·4
1936	67·7	97·3	97·0
1937	69·7	100·1	107·4
1938	71·3	102·5	101·4
1939	71·9	103·3	102·0
1940	75·2	107·9	108·8
1941	80·3	115·3	122·1
1942	85·3	122·5	131·1
1943	91·8	131·9	137·9
1944	93·2	133·9	144·8
1945	94·1[1]	135·5[1]	144·8[2]

Source: See Appendix A.

[1] Preliminary.

[2] A special investigation was made by the Prices Branch of the Dominion Bureau of Statistics to examine the reasons for the index of wholesale prices of building materials yielding the same results in 1945 as in 1944. The inquiry showed that wholesale prices of a number of building materials rose during 1945 while at the same time wholesale prices of selected items declined as a result of the removal of the sales tax and the War Exchange Conservation tax. Hence resultant decreases offset increases and the index remained at the 1944 level. The index does not take account of changes of retail prices or deterioration of quality.

TABLE VI.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE A. WOOD FRAME WITH WOOD CLAPBOARD

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	250	175.00
(2) Aggregates for concrete	Cu. yds.	1.50	56	84.00
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	259.00
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	1,000	26·00
(5) Brick for exterior walls	No.	—	—	—
(6) Stone facing	Sq. yds.	—	—	—
(7) Field title sub-drainage	Ft.	.08	180	14.40
(8) Vitrified flue linings	Ft.	.50	50	25.00
Sub-total	—	—	—	65.40
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	65.00M	6,400	416.00
(10) Yard lumber, rough and surfaced	B.M. ft.	60.00M	6,000	360.00
(11) Wood clapboard for exterior walls	Sq. ft.	.10	1,800	180.00
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,200	240.00
(13) Flooring—hardwood	B.M. ft.	135.00M	750	101.25
(14) Flooring—softwood	B.M. ft.	75.00M	750	56.25
(15) Interior millwork—doors, doors and windows trim, base boards	B.M. ft.	230.00M	920	211.60
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	1,685.10
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.60	2,100	126.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	400	240.00
(20) Building paper—inside	Rolls	2.90	7	20.30
(21) Building paper—outside	Rolls	2.15	8	17.20
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	403.50
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	15	120.00
(24) Roofing—dry felt (20 year roof)	Rolls	—	—	—
(25) Roofing—tar felt	Rolls	—	—	—
(26) Roofing—pitch	Lbs.	—	—	—
(27) Roofing—gravel	Tons	—	—	—
Sub-total	—	—	—	120.00
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	200	30.00
(29) Paint—outside (oil)	Gals.	4.00	8	32.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	128.00

TABLE VI.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE A. WOOD FRAME WITH WOOD CLAPBOARD—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures—*				
(33) Plumbing—6″ cast iron pipe with fittings..	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings..	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	30	16.50
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	50	25.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	30	13.50
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	120	18.00
(40) Plumbing—¾″ lead pipe water service....	L. ft.	.45	50	22.50
(41) Heating—warm air furnaces	No.	100.00	1	100.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash Basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	50	20.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	349	139.60
Sub-total	—	—	—	678.10
VIII. *Electrical Equipment and Fixtures—*				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials—*				
(55) Metal window balances	Pairs	1.30	15	19.50
(56) Metal weatherstrips	Ft.	.10	240	24.00
(57) Sheet metal eavestroughs	L. ft.	.30	120	36.00
(58) Sheet metal down spouts	L. ft.	.30	50	15.00
(59) Sheet metal roof flashings	Sq. ft.	.30	40	12.00
(60) Rough hardware	Lbs.	.08	400	32.00
(61) Finish hardware	—	—	—	50.00
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	188.50
Total	—	—	—	3,662.60

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE VII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE B. WOOD FRAME AND BRICK VENEER

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	250	175.00
(2) Aggregates for concrete	Cu. yds.	1.50	56	84.00
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	259.00
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	1,000	26.00
(5) Brick for exterior walls	No.	33.00M	11,085	365.81
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	180	14.40
(8) Vitrified flue linings	Ft.	.50	50	25.00
Sub-total	—	—	—	431.21
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	65.00M	6,400	416.00
(10) Yard lumber, rough and surfaced	B.M. ft.	60.00M	6,000	360.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,200	240.00
(13) Flooring—hardwood	B.M. ft.	135.00M	750	101.25
(14) Flooring—softwood	B.M. ft.	75.00M	750	56.25
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	920	211.60
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	1,505.10
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	2,100	126.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	400	240.00
(20) Building paper—inside	Rolls	2.90	7	20.30
(21) Building paper—outside	Rolls	2.15	8	17.20
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	403.50
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	15	120.00
(24) Roofing—dry felt (20 year roof)	Rolls	—	—	—
(25) Roofing—tar felt	Rolls	—	—	—
(26) Roofing—pitch	Lbs.	—	—	—
(27) Roofing—gravel	Tons	—	—	—
Sub-total	—	—	—	120.00
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	200	30.00
(29) Paint—outside (oil)	Gals.	4.00	1	4.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	100.00

TABLE VII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE B. WOOD FRAME AND BRICK VENEER—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures—*				
(33) Plumbing—6″ cast iron pipe with fittings	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	30	16.50
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	50	25.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	30	13.50
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	120	18.00
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	50	22.50
(41) Heating—warm air furnaces	No.	100.00	1	100.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	50	20.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	349	139.60
Sub-total	—	—	—	678.10
VIII. *Electrical Equipment and Fixtures—*				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials—*				
(55) Metal window balances	Pairs	1.30	15	19.50
(56) Metal weatherstrips	Ft.	.10	240	24.00
(57) Sheet metal eavestroughs	L. ft.	.30	120	36.00
(58) Sheet metal down spouts	L. ft.	.30	50	15.00
(59) Sheet metal roof flashings	Sq. ft.	.30	40	12.00
(60) Rough hardware	Lbs.	.08	350	28.00
(61) Finish hardware	—	—	—	50.00
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	184.50
Total	—	—	—	3,816.41

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE VIII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE C. WOOD FRAME WITH STUCCO ON LATH

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	250	175.00
(2) Aggregates for concrete	Cu. yds.	1.50	56	84.00
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	259.00
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	1,000	26.00
(5) Brick for exterior walls	No.	—	—	—
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	180	14.40
(8) Vitrified flue linings	Ft.	.50	50	25.00
Sub-total	—	—	—	65.40
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	65.00M	6,400	416.00
(10) Yard lumber, rough and surfaced	B.M. ft.	60.00M	6,000	360.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,200	240.00
(13) Flooring—hardwood	B.M. ft.	135.00M	750	101.25
(14) Flooring—softwood	B.M. ft.	75.00M	750	56.25
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	920	211.60
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	1,505.10
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	2,100	126.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	400	240.00
(20) Building paper—inside	Rolls	2.90	7	20.30
(21) Building paper—outside	Rolls	2.15	8	17.20
(22) Exterior plaster—stucco	Sq. yds.	1.50	160	240.00
Sub-total	—	—	—	643.50
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	15	120.00
(24) Roofing—dry felt (20 year roof)	Rolls	—	—	—
(25) Roofing—tar felt	Rolls	—	—	—
(26) Roofing—pitch	Lbs.	—	—	—
(27) Roofing—gravel	Tons	—	—	—
Sub-total	—	—	—	120.00
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	200	30.00
(29) Paint—outside (oil)	Gals.	4.00	1	4.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	100.00

TABLE VIII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE C. WOOD FRAME WITH STUCCO ON LATH—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures—*				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	30	16.50
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	50	25.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	30	13.50
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	120	18.00
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	50	22.50
(41) Heating—warm air furnaces	No.	100.00	1	100.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	50	20.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	349	139.60
Sub-total	—	—	—	678.10
VIII. *Electrical Equipment and Fixtures—*				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials—*				
(55) Metal window balances	Pairs	1.30	15	19.50
(56) Metal weatherstrips	Ft.	.10	240	24.00
(57) Sheet metal eavestroughs	L. ft.	.30	120	36.00
(58) Sheet metal down spouts	L. ft.	.30	50	15.00
(59) Sheet metal roof flashings	Sq. ft.	.30	40	12.00
(60) Rough hardware	Lbs.	.08	350	28.00
(61) Finish hardware	—	—	—	50.00
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	184.50
Total	—	—	—	3,690.60

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE IX.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE D. CONCRETE MASONRY BLOCKS AND STUCCO

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	250	175.00
(2) Aggregates for concrete	Cu. yds.	1.50	56	84.00
(3) Masonry blocks	No.	.20	1,600	320.00
Sub-total	—	—	—	579.00
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	1,000	26.00
(5) Brick for exterior walls	No.	—	—	—
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	180	14.40
(8) Vitrified flue linings	Ft.	.50	50	25.00
Sub-total	—	—	—	65.40
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	5,000	375.00
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	4,300	301.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,200	240.00
(13) Flooring—hardwood	B.M. ft.	135.00M	750	101.25
(14) Flooring—softwood	B.M. ft.	75.00M	750	56.25
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	920	211.60
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	.02	400	8.00
Sub-total	—	—	—	1,413.10
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	650	39.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	400	240.00
(20) Building paper—inside	Rolls	—	—	—
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	1.00	160	160.00
Sub-total	—	—	—	439.00
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	15	120.00
(24) Roofing—dry felt (20 year roof)	Rolls	—	—	—
(25) Roofing—tar felt	Rolls	—	—	—
(26) Roofing—pitch	Lbs.	—	—	—
(27) Roofing—gravel	Tons	—	—	—
Sub-total	—	—	—	120.00
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	200	30.00
(29) Paint—outside (oil)	Gals.	4.00	1	4.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	100.00

TABLE IX.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE D. CONCRETE MASONRY BLOCKS AND STUCCO—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	30	16.50
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	50	25.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	30	13.50
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	120	18.00
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	50	22.50
(41) Heating—warm air furnaces	No.	100.00	1	100.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	50	20.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	349	139.60
Sub-total	—	—	—	678.10
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	15	19.50
(56) Metal weatherstrips	Ft.	.10	240	24.00
(57) Sheet metal eavestroughs	L. ft.	.30	120	36.00
(58) Sheet metal down spouts	L. ft.	.30	50	15.00
(59) Sheet metal roof flashings	Sq. ft.	.30	40	12.00
(60) Rough hardware	Lbs.	.08	300	24.00
(61) Finish hardware	—	—	—	50.00
(62) Damp proofing	Gals.	1.35	22	29.70
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	210.20
Total	—	—	—	3,739.80

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE X.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE E. SOLID MASONRY: BRICK FACING AND MASONRY BLOCKS

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	250	175.00
(2) Aggregates for concrete	Cu. yds.	1.50	56	84.00
(3) Masonry blocks	No.	.20	1,600	320.00
Sub-total	—	—	—	579.00
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	1,000	26.00
(5) Brick for exterior walls	No.	33.00M	11,100	366.30
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	180	14.40
(8) Vitrified flue linings	Ft.	.50	50	25.00
Sub-total	—	—	—	431.70
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	5,000	375.00
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	4,300	301.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,700	340.00
(13) Flooring—hardwood	B.M. ft.	135.00M	750	101.25
(14) Flooring—softwood	B.M. ft.	75.00M	750	56.25
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	920	211.60
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	.02	400	8.00
Sub-total	—	—	—	1,513.10
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	650	39.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	400	240.00
(20) Building paper—inside	Rolls	—	—	—
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	279.00
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	15	120.00
(24) Roofing—dry felt (20 year roof)	Rolls	—	—	—
(25) Roofing—tar felt	Rolls	—	—	—
(26) Roofing—pitch	Lbs.	—	—	—
(27) Roofing—gravel	Tons	—	—	—
Sub-total	—	—	—	120.00
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	200	30.00
(29) Paint—outside (oil)	Gals.	4.00	2	8.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	104.00

TABLE X.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE E, SOLID MASONRY: BRICK FACING AND MASONRY BLOCKS—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	30	16.50
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	50	25.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	30	13.50
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	120	18.00
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	50	22.50
(41) Heating—warm air furnaces	No.	100.00	1	100.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	50	20.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	349	139.60
Sub-total	—	—	—	678.10
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	60.00
Sub-total	—	—	—	150.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	15	19.50
(56) Metal weatherstrips	Ft.	.10	240	24.00
(57) Sheet metal eavestroughs	L. ft.	.30	120	36.00
(58) Sheet metal down spouts	L. ft.	.30	50	15.00
(59) Sheet metal roof flashings	Sq. ft.	.30	40	12.00
(60) Rough hardware	Lbs.	.08	300	24.00
(61) Finish hardware	—	—	—	50.00
(62) Damp proofing	Gals.	1.35	22	29.70
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	210.20
Total	—	—	—	4,065.10

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XI.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE F. SOLID BRICK

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	250	175.00
(2) Aggregates for concrete	Cu. yds.	1.50	56	84.00
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	259.00
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	1,000	26.00
(5) Brick for exterior walls	No.	33.00M	22,000	726.00
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	180	14.40
(8) Vitrified flue linings	Ft.	.50	50	25.00
Sub-total	—	—	—	791.40
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	5,000	375.00
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	4,300	301.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,700	340.00
(13) Flooring—hardwood	B.M. ft.	135.00M	750	101.25
(14) Flooring—softwood	B.M. ft.	75.00M	750	56.25
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	920	211.60
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	.02	400	8.00
Sub-total	—	—	—	1,513.10
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	650	39.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	400	240.00
(20) Building paper—inside	Rolls	—	—	—
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	279.00
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	15	120.00
(24) Roofing—dry felt (20 year roof)	Rolls	—	—	—
(25) Roofing—tar felt	Rolls	—	—	—
(26) Roofing—pitch	Lbs.	—	—	—
(27) Roofing—gravel	Tons	—	—	—
Sub-total	—	—	—	120.00
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	200	30.00
(29) Paint—outside (oil)	Gals.	4.00	2	8.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	104.00

TABLE XI.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE F. SOLID BRICK—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	30	16.50
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	50	25.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	30	13.50
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—¾″ galvanized steel water pipe	L. ft.	.15	120	18.00
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	50	22.50
(41) Heating—warm air furnaces	No.	100.00	1	100.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	50	20.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	349	139.60
Sub-total	—	—	—	678.10
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	60.00
Sub-total	—	—	—	150.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	15	19.50
(56) Metal weatherstrips	Ft.	.10	240	24.00
(57) Sheet metal eavestroughs	L. ft.	.30	120	36.00
(58) Sheet metal down spouts	L. ft.	.30	50	15.00
(59) Sheet metal roof flashings	Sq. ft.	.30	40	12.00
(60) Rough hardware	Lbs.	.08	300	24.00
(61) Finish hardware	—	—	—	50.00
(62) Damp proofing	Gals.	1.35	22	29.70
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	210.20
Total	—	—	—	4,104.80

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE G. SOLID MASONRY: MASONRY BLOCKS WITH PART STONE FACING AND PART STUCCO

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	300	210.00
(2) Aggregates for concrete	Cu. yds.	1.50	65	97.50
(3) Masonry blocks	No.	.20	1,600	320.00
Sub-total	—	—	—	627.50
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	1,000	26.00
(5) Brick for exterior walls	No.	—	—	—
(6) Stone facing	Sq. yds.	4.50	80	360.00
(7) Field tile sub-drainage	Ft.	.08	180	14.40
(8) Vitrified flue linings	Ft.	.50	50	25.00
Sub-total	—	—	—	425.40
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	5,000	375.00
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	4,300	301.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,700	340.00
(13) Flooring—hardwood	B.M. ft.	135·00M	750	101.25
(14) Flooring—softwood	B.M. ft.	75.00M	750	56.25
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	920	211.60
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	.02	400	8.00
Sub-total	—	—	—	1,513.10
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	650	39.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	400	240.00
(20) Building paper—inside	Rolls	—	—	—
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	1.00	80	80.00
Sub-total	—	—	—	359.00
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	8.00	15	120.00
(24) Roofing—dry felt (20 year roof)	Rolls	—	—	—
(25) Roofing—tar felt	Rolls	—	—	—
(26) Roofing—pitch	Lbs.	—	—	—
(27) Roofing—gravel	Tons	—	—	—
Sub-total	—	—	—	120.00
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	200	30.00
(29) Paint—outside (oil)	Gals.	4.00	2	8.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	104.00

TABLE XII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—SINGLE HOUSE, TYPE G. SOLID MASONRY: MASONRY BLOCKS WITH PART STONE FACING AND PART STUCCO—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	30	16.50
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	50	25.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	30	13.50
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	120	18.00
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	50	22.50
(41) Heating—warm air furnaces	No.	100.00	1	100.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	50	20.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	349	139.60
Sub-total	—	—	—	678.10
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	60.00
Sub-total	—	—	—	150.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	15	19.50
(56) Metal weatherstrips	Ft.	.10	240	24.00
(57) Sheet metal eavestroughs	L. ft.	.30	120	36.00
(58) Sheet metal down spouts	L. ft.	.30	50	15.00
(59) Sheet metal roof flashings	Sq. ft.	.30	40	12.00
(60) Rough hardware	Lbs.	.08	300	24.00
(61) Finish hardware	—	—	—	50.00
(62) Damp proofing	Gals.	1.35	22	29.70
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	210.20
Total	—	—	—	4,187.30

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XIII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE A. WOOD FRAME WITH WOOD CLAPBOARD

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	133	93.10
(2) Aggregates for concrete	Cu. yds.	1.50	29	43.50
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	136.60
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	800	20.80
(5) Brick for exterior walls	No.	—	—	—
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	73	5.84
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	26.64
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	65.00M	4,800	312.00
(10) Yard lumber, rough and surfaced	B.M. ft.	60.00M	4,500	270.00
(11) Wood clapboard for exterior walls	Sq. ft.	.10	1,000	100.00
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,100	220.00
(13) Flooring—hardwood	B.M. ft.	135.00M	1,167	157.55
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	670	154.10
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	1,333.65
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	1,167	70.02
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	367	220.20
(20) Building paper—inside	Rolls	2.90	4	11.60
(21) Building paper—outside	Rolls	2.15	5	10.75
(22) Exterior plaster—stucco	Sq.yds.	—	—	—
Sub-total	—	—	—	312.57
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	167	25.05
(29) Paint—outside (oil)	Gals.	4.00	7	28.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	119.05

TABLE XIII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE A. WOOD FRAME WITH WOOD CLAPBOARD—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures—*				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	27	14.85
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	47	23.50
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	27	12.15
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	107	16.05
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	47	21.15
(41) Heating—warm air furnaces	No.	200.00	.33	66.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	40	16.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	200	80.00
Sub-total	—	—	—	572.70
VIII. *Electrical Equipment and Fixtures—*				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials—*				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	200	20.00
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	107	32.10
(60) Rough hardware	Lbs.	.08	275	22.00
(61) Finish hardware	—	—	—	33.00
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	121.40
Total	—	—	—	2,796.04

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XIV.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE B. WOOD FRAME AND BRICK VENEER

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	133	93.10
(2) Aggregates for concrete	Cu. yds.	1.50	29	43.50
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	136.60
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	800	20.80
(5) Brick for exterior walls	No.	33.00M	6,000	198.00
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	73	5.84
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	224.64
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	65.00M	4,800	312.00
(10) Yard lumber, rough and surfaced	B.M. ft.	60.00M	4,500	270.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,100	220.00
(13) Flooring—hardwood	B.M. ft.	135.00M	1,167	157.55
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	670	154.10
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	1,233.65
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	1,167	70.02
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	367	220.20
(20) Building paper—inside	Rolls	2.90	4	11.60
(21) Building paper—outside	Rolls	2.15	5	10.75
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	312.57
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	167	25.05
(29) Paint—outside (oil)	Gals.	4.00	1	4.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	95.05

TABLE XIV.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE B. WOOD FRAME AND BRICK VENEER—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	27	14.85
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	47	23.50
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	27	12.15
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	107	16.05
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	47	21.15
(41) Heating—warm air furnaces	No.	200.00	.33	66.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	40	16.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	200	80.00
Sub-total	—	—	—	572.70
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	200	20.00
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	107	32.10
(60) Rough hardware	Lbs.	.08	225	18.00
(61) Finish hardware	—	—	—	33.00
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	117.40
Total	—	—	—	2,866.04

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XV.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE C. WOOD FRAME WITH STUCCO ON LATH

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	133	93.10
(2) Aggregates for concrete	Cu. yds.	1.50	29	43.50
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	136.60
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	800	20.80
(5) Brick for exterior walls	No.	—	—	—
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	73	5.84
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	26.64
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	65.00M	4,800	312.10
(10) Yard lumber, rough and surfaced	B.M. ft.	60.00M	4,500	270.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,100	220.00
(13) Flooring—hardwood	B.M. ft.	135.00M	1,167	157.55
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	670	154.10
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	1,233.65
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	1,167	70.02
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	367	220.20
(20) Building paper—inside	Rolls	2.90	4	11.60
(21) Building paper—outside	Rolls	2.15	5	10.75
(22) Exterior plaster—stucco	Sq. yds.	1.50	110	165.00
Sub-total	—	—	—	477.57
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	167	25.05
(29) Paint—outside (oil)	Gals.	4.00	1	4.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	95.05

TABLE XV.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPE UNIT HOUSE, TYPE C. WOOD FRAME WITH STUCCO ON LATH—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	27	14.85
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	47	23.50
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	27	12.15
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	107	16.05
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	47	21.15
(41) Heating—warm air furnaces	No.	200.00	.33	66.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	40	16.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	200	80.00
Sub-total	—	—	—	572.70
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	200	20.00
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	107	32.10
(60) Rough hardware	Lbs.	.08	225	18.00
(61) Finish hardware	—	—	—	33.00
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	117.40
Total	—	—	—	2,833.04

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XVI.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE D. CONCRETE MASONRY BLOCKS AND STUCCO

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	133	93.10
(2) Aggregates for concrete	Cu. yds.	1.50	29	43.50
(3) Masonry blocks	No.	.20	1,000	200.00
Sub-total	—	—	—	336.60
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	800	20.80
(5) Brick for exterior walls	No.	—	—	—
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	73	5.84
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	26.64
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	2,500	187.50
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	2,400	168.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,100	220.00
(13) Flooring—hardwood	B.M. ft.	135.00M	1,167	157.55
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	670	154.10
(16) Interior millwork—kitchen cupboards	B.M. ft.	— [1]	80	120.00
(17) Strapping	L. ft.	.02	200	4.00
Sub-total	—	—	—	1,011.15
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	500	30.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	367	220.20
(20) Building paper—inside	Rolls	—	—	—
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	1.00	110	110.00
Sub-total	—	—	—	360.20
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	167	25.05
(29) Paint—outside (oil)	Gals.	4.00	1	4.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	95.05

TABLE XVI.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE D. CONCRETE MASONRY BLOCKS AND STUCCO—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures—*				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	27	14.85
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	47	23.50
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	27	12.15
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	107	16.05
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	47	21.15
(41) Heating—warm air furnaces	No.	200.00	.33	66.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	40	16.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	200	80.00
Sub-total	—	—	—	572.70
VIII. *Electrical Equipment and Fixtures—*				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials—*				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	200	20.00
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	107	32.10
(60) Rough hardware	Lbs.	.08	175	14.00
(61) Finish hardware	—	—	—	33.00
(62) Damp proofing	Gals.	1.35	10	13.50
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	126.90
Total	—	—	—	2,702.67

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XVII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE E. SOLID MASONRY: BRICK FACING AND MASONRY BLOCKS

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	133	93.10
(2) Aggregates for concrete	Cu. yds.	1.50	29	43.50
(3) Masonry blocks	No.	.20	1,000	200.00
Sub-total	—	—	—	336.60
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	800	20.80
(5) Brick for exterior walls	No.	33.00M	6,000	198.00
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	73	5.84
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	224.64
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	2,500	187.50
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	2,400	168.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,400	280.00
(13) Flooring—hardwood	B.M. ft.	135.00M	1,167	157.55
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	670	154.10
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	.02	200	4.00
Sub-total	—	—	—	1,071.15
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	500	30.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	367	220.20
(20) Building paper—inside	Rolls	—	—	—
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	250.20
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	167	25.05
(29) Paint—outside (oil)	Gals.	4.00	2	8.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	99.05

TABLE XVII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE E. SOLID MASONRY: BRICK FACING AND MASONRY BLOCKS—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	27	14.85
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	47	23.50
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	27	12.15
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	107	16.05
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	45	21.15
(41) Heating—warm air furnaces	No.	200.00	.33	66.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	40	16.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	200	80.00
Sub-total	—	—	—	572.70
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	200	20.00
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	107	32.10
(60) Rough hardware	Lbs.	.08	175	14.00
(61) Finish hardware	—	—	—	33.00
(62) Damp proofing	Gals.	1.35	10	13.50
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	126.90
Total	—	—	—	2,854.67

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XVIII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE F. SOLID BRICK

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	133	93.10
(2) Aggregates for concrete	Cu. yds.	1.50	29	43.50
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	136.60
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	800	20.80
(5) Brick for exterior walls	No.	33.00M	13,000	429.00
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	73	5.84
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	455.64
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	2,500	187.50
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	2,400	168.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,400	280.00
(13) Flooring—hardwood	B.M. ft.	135.00M	1,167	157.55
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	670	154.10
(16) Interior millwork—kitchen cupboards	B.M. ft.	— [1]	80	120.00
(17) Strapping	L. ft.	.02	200	4.00
Sub-total	—	—	—	1,071.15
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	500	30.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	367	220.20
(20) Building paper—inside	Rolls	—	—	—
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	250.20
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	167	25.05
(29) Paint—outside (oil)	Gals.	4.00	2	8.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	99.05

TABLE XVIII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE F. SOLID BRICK—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	27	14.85
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	47	23.50
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	27	12.15
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	107	16.05
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	47	21.15
(41) Heating—warm air furnaces	No.	200.00	.33	66.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	40	16.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	200	80.00
Sub-total	—	—	—	572.70
VIII. *Electrical Equipment and Fixtures*——				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	200	20.00
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	107	32.10
(60) Rough hardware	Lbs.	.08	175	14.00
(61) Finish hardware	—	—	—	33.00
(62) Damp proofing	Gals.	1.35	10	13.50
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	126.90
Total	—	—	—	2,885.67

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XIX.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE G. SOLID MASONRY: MASONRY BLOCKS WITH PART STONE FACING AND PART STUCCO

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	150	105.00
(2) Aggregates for concrete	Cu. yds.	1.50	33	49.50
(3) Masonry blocks	No.	.20	1,000	200.00
Sub-total	—	—	—	354.50
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	800	20.80
(5) Brick for exterior walls	No.	—	—	—
(6) Stone facing	Sq. yds.	4.50	55	247.50
(7) Field tile sub-drainage	Ft.	.08	73	5.84
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	274.14
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	2,500	187.50
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	2,400	168.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,400	280.00
(13) Flooring—hardwood	B.M. ft.	135.00M	1,167	157.55
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	670	154.10
(16) Interior millwork—kitchen cupboards	B.M. ft.	—(1)	80	120.00
(17) Strapping	L. ft.	.02	200	4.00
Sub-total	—	—	—	1,071.15
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	500	30.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	367	220.20
(20) Building paper—inside	Rolls	—	—	—
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	1.00	55	55.00
Sub-total	—	—	—	305.20
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	167	25.05
(29) Paint—outside (oil)	Gals.	4.00	2	8.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	99.05

TABLE XIX.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—MULTIPLE UNIT HOUSE, TYPE G. SOLID MASONRY: MASONRY BLOCKS WITH PART STONE FACING AND PART STUCCO—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures—*				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	27	14.85
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	47	23.50
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	27	12.15
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	107	16.05
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	47	21.15
(41) Heating—warm air furnaces	No.	200.00	.33	66.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	1	32.00
(47) Wash basins	No.	27.00	1	27.00
(48) Bathtubs	No.	80.00	1	80.00
(49) Combination tub and sink	No.	50.00	1	50.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	40	16.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	200	80.00
Sub-total	—	—	—	572.70
VIII. *Electrical Equipment and Fixtures—*				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials—*				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	200	20.00
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	107	32.10
(60) Rough hardware	Lbs.	.08	175	14.00
(61) Finish hardware	—	—	—	33.00
(62) Damp proofing	Gals.	1.35	10	13.50
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	126.90
Total	—	—	—	2,977.07

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XX.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—ROW HOUSE, TYPE B. WOOD FRAME AND BRICK VENEER

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	134	93.80
(2) Aggregates for concrete	Cu. yds.	1.50	30	45.00
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	138.80
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	26.00M	467	12.14
(5) Brick for exterior walls	No.	33.00M	5,400	178.20
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	74	5.92
(8) Vitrified flue linings	Ft.	.50	20	10.00
Sub-total	—	—	—	206.26
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	65.00M	4,800	312.00
(10) Yard lumber, rough and surfaced	B.M. ft.	60.00M	4,500	270.00
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	1,100	220.00
(13) Flooring—hardwood	B.M. ft.	135.00M	1,167	157.55
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	670	154.10
(16) Interior millwork—kitchen cupboards	B.M. ft.	— [1]	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	1,233.65
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	1,167	70.02
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.50	367	183.50
(20) Building paper—inside	Rolls	2.90	4	11.60
(21) Building paper—outside	Rolls	2.15	5	10.75
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	275.87
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	167	25.05
(29) Paint—outside (oil)	Gals.	4.00	1	4.00
(30) Paint—inside	Gals.	4.00	6	24.00
(31) Varnish	Gals.	6.00	6	36.00
(32) Shellac	Gals.	6.00	1	6.00
Sub-total	—	—	—	95.05

TABLE XX.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—ROW HOUSE, TYPE B. WOOD FRAME AND BRICK VENEER—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings.	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	65	104.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	27	14.85
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	47	23.50
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	27	12.15
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	107	16.05
(40) Plumbing—¾″ lead pipe water service	L. ft.	.45	47	21.15
(41) Heating—warm air furnaces	No.	133.00	.50	66.50
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	30.00	1	30.00
(47) Wash basins	No.	25.00	1	25.00
(48) Bathtubs	No.	65.00	1	65.00
(49) Combination tub and sink	No.	45.00	1	45.00
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	.40	40	16.00
(52) Smoke pipes and warm air ducts	Sq. ft.	.40	200	80.00
Sub-total	—	—	—	549.20
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	90.00
(54) Electrical fixtures	—	—	—	45.00
Sub-total	—	—	—	135.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	200	20.00
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	107	32.10
(60) Rough hardware	Lbs.	.08	225	18.00
(61) Finish hardware	—	—	—	33.00
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	117.40
Total	—	—	—	2,789.66

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XXI.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—APARTMENT HOUSE, TYPE E. SOLID MASONRY: BRICK FACING AND MASONRY BLOCKS

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	.70	113	79.10
(2) Aggregates for concrete	Cu. yds.	1.50	24	36.00
(3) Masonry blocks	No.	.20	469	93.80
Sub-total	—	—	—	208.90
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	30.00M	319	9.57
(5) Brick for exterior walls	No.	33.00M	3,000	99.00
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	.08	17	1.36
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	109.93
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	75.00M	2,188	164.10
(10) Yard lumber, rough and surfaced	B.M. ft.	70.00M	3,750	262.50
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	875	175.00
(13) Flooring—hardwood	B.M. ft.	135.00M	938	126.63
(14) Flooring—softwood	B.M. ft.	—	—	—
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M. ft.	230.00M	2,500	575.00
(16) Interior millwork—kitchen cupboards	B.M. ft.	—[1]	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	1,423.23
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	256	15.36
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.50	463	231.50
(20) Building paper—inside	Rolls	2.90	4	11.60
(21) Building paper—outside	Rolls	—	—	—
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	258.46
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	.60	1.25	.75
(25) Roofing—tar felt	Rolls	2.60	7	18.20
(26) Roofing—pitch	Lbs.	.0225	750	16.88
(27) Roofing—gravel	Tons	2.60	1	2.60
Sub-total	—	—	—	38.43
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.20	324	64.80
(29) Paint—outside (oil)	Gals.	4.00	6	24.00
(30) Paint—inside	Gals.	4.00	10	40.00
(31) Varnish	Gals.	6.00	3	18.00
(32) Shellac	Gals.	6.00	2	12.00
Sub-total	—	—	—	158.80

TABLE XXI.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—APARTMENT HOUSE, TYPE E. SOLID MASONRY: BRICK FACING AND MASONRY BLOCKS—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings..	L. ft.	1.75	25	43.75
(34) Plumbing—4″ cast iron pipe with fittings.	L. ft.	1.60	50	80.00
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	63	34.65
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	38	19.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	32	14.40
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	.35	75	26.25
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	—	—	—
(40) Plumbing—¾″ lead pipe water service	L. ft.	—	—	—
(41) Heating—hot water furnaces	No.	1,200.00	.0625	75.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	1.40	31	43.40
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	1.05	31	32.55
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	.55	63	34.65
(45) Cast iron radiators	Sq. ft.	.55	250	137.50
(46) Toilets	No.	30.00	1	30.00
(47) Wash basins	No.	25.00	1	25.00
(48) Bathtubs	No.	65.00	1	65.00
(49) Combination tub and sink	No.	45.00	1	45.00
(50) Domestic hot water heater	No.	170.00	.0625	10.63
(51) Vitrified clay sewer drain	Ft.	.40	3	1.20
(52) Smoke pipes and warm air ducts	Sq. ft.	—	—	—
Sub-total	—	—	—	717.98
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	120.00
(54) Electrical fixtures	—	—	—	79.00
Sub-total	—	—	—	199.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	11	14.30
(56) Metal weatherstrips	Ft.	.10	194	19.40
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	44	13.20
(60) Rough hardware	Lbs.	.08	175	14.00
(61) Finish hardware	—	—	—	—
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	1.65	13	21.45
Sub-total	—	—	—	82.35
Total	—	—	—	3,177.87

Source: See Appendix A.

(1) As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

TABLE XXII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—CONVERTED HOUSE, TYPE B. WOOD FRAME AND BRICK VENEER

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
I. *Cement, Gravel and Sand—*				
(1) Cement	Bags	—	—	—
(2) Aggregates for concrete	Cu. yds.	—	—	—
(3) Masonry blocks	No.	—	—	—
Sub-total	—	—	—	—
II. *Brick, Tile and Stone—*				
(4) Brick for chimneys	No.	—	—	—
(5) Brick for exterior walls	No.	33.00M	250	8.25
(6) Stone facing	Sq. yds.	—	—	—
(7) Field tile sub-drainage	Ft.	—	—	—
(8) Vitrified flue linings	Ft.	—	—	—
Sub-total	—	—	—	8.25
III. *Lumber and its Products—*				
(9) Structural (dimension) lumber	B.M. ft.	65.00M	467	30.36
(10) Yard lumber, rough and surfaced	B.M. ft.	60.00M	375	22.50
(11) Wood clapboard for exterior walls	Sq. ft.	—	—	—
(12) Exterior millwork—doors, windows, porch frames, cornices	B.M. ft.	200.00M	267	53.40
(13) Flooring—hardwood	B.M. ft.	135.00M	538	72.63
(14) Flooring—softwood	B.M. ft.	75.00M	150	11.25
(15) Interior millwork—doors, doors and windows trim, baseboards	B.M.ft.	230.00M	300	69.00
(16) Interior millwork—kitchen cupboards[1]	B.M.ft.	— [1]	80	120.00
(17) Strapping	L. ft.	—	—	—
Sub-total	—	—	—	379.14
IV. *Lath, Plaster and Insulation Materials—*				
(18) Insulating materials—rock wool	Sq. ft.	.06	300	18.00
(19) Interior plaster (on gypsum, fibre board or wood lath)	Sq. yds.	.60	163	97.80
(20) Building paper—inside	Rolls	2.90	1.50	4.35
(21) Building paper—outside	Rolls	2.15	.75	1.61
(22) Exterior plaster—stucco	Sq. yds.	—	—	—
Sub-total	—	—	—	121.76
V. *Roofing Materials—*				
(23) Roofing—shingles	Squares	—	—	—
(24) Roofing—dry felt (20 year roof)	Rolls	—	—	—
(25) Roofing—tar felt	Rolls	—	—	—
(26) Roofing—pitch	Lbs.	—	—	—
(27) Roofing—gravel	Tons	—	—	—
Sub-total	—	—	—	—
VI. *Paint and Glass—*				
(28) Glass	Sq. ft.	.15	13	1.95
(29) Paint—outside (oil)	Gals.	4.00	.50	2.00
(30) Paint—inside	Gals.	3.55	7.50	26.63
(31) Varnish	Gals.	6.00	3	18.00
(32) Shellac	Gals.	6.00	.50	3.00
Sub-total	—	—	—	51.58

TABLE XXII.—ESTIMATED BUILDING MATERIAL REQUIREMENTS OF ONE DWELLING UNIT—CONVERTED HOUSE, TYPE B. WOOD FRAME AND BRICK VENEER—*Continued*

Kind of building material used	Type of unit of material	Cost per unit of material	Material requirements	
			Number of units	Value
		$		$
VII. *Plumbing and Heating Equipment and Fixtures*—				
(33) Plumbing—6″ cast iron pipe with fittings	L. ft.	—	—	—
(34) Plumbing—4″ cast iron pipe with fittings	L. ft.	1.60	31	49.60
(35) Plumbing—2″ galvanized steel pipe with fittings	L. ft.	.55	25	13.75
(36) Plumbing—1½″ galvanized steel pipe with fittings	L. ft.	.50	50	25.00
(37) Plumbing—1¼″ galvanized steel pipe with fittings	L. ft.	.45	38	17.10
(38) Plumbing—1″ galvanized steel pipe with fittings	L. ft.	—	—	—
(39) Plumbing—½″ galvanized steel water pipe	L. ft.	.15	75	11.25
(40) Plumbing—¾″ lead pipe water service	L. ft.	—	—	—
(41) Heating—warm air furnaces	No.	100.00	.25	25.00
(42) Heating—4″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(43) Heating—3″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(44) Heating—2″ wrought iron hot water pipe with fittings	L. ft.	—	—	—
(45) Cast iron radiators	Sq. ft.	—	—	—
(46) Toilets	No.	32.00	.75	24.00
(47) Wash basins	No.	27.00	.75	20.25
(48) Bathtubs	No.	80.00	.75	60.00
(49) Combination tub and sink	No.	50.00	.75	37.50
(50) Domestic hot water heater	No.	30.00	1	30.00
(51) Vitrified clay sewer drain	Ft.	—	—	—
(52) Smoke pipes and warm air ducts	Sq. ft.	—	—	—
Sub-total	—	—	—	313.45
VIII. *Electrical Equipment and Fixtures*—				
(53) Electrical wiring	—	—	—	35.00
(54) Electrical fixtures	—	—	—	15.00
Sub-total	—	—	—	50.00
IX. *Other Materials*—				
(55) Metal window balances	Pairs	1.30	1.50	1.95
(56) Metal weatherstrips	Ft.	—	—	—
(57) Sheet metal eavestroughs	L. ft.	—	—	—
(58) Sheet metal down spouts	L. ft.	—	—	—
(59) Sheet metal roof flashings	Sq. ft.	.30	72	21.60
(60) Rough hardware	Lbs.	.08	172	13.76
(61) Finish hardware	—	—	—	10.86
(62) Damp proofing	Gals.	—	—	—
(63) Linoleum	Sq. yds.	—	—	—
Sub-total	—	—	—	48.17
Total	—	—	—	972.35

Source: See Appendix A.

(1) In converted houses of the above type, kitchen cupboards are included in the quantities and costs of interior millwork in order to arrive at a valuation based upon desirable standards of construction. As a result of the small quantity of interior millwork used for kitchen cupboards, cost per unit of material in terms of M feet exaggerates the relative cost pattern. Consequently only the number of units used and value of same are shown.

APPENDIX C

Procedure for Arriving at Estimates of Local Building Material Requirements

APPENDIX C

PROCEDURE FOR ARRIVING AT ESTIMATES OF LOCAL BUILDING MATERIAL REQUIREMENTS

Estimates of national requirements for a housing program, both of manpower and materials, presented in the body of the report, do not divulge the special needs of particular regions and localities. The sum total of all those local needs, however, determines the volume of demand for manpower and materials for the country as a whole and success in meeting these needs would be greatly enhanced if it were possible to supplement national with regional and local estimates. This would allow for the taking of remedial action within the locality, assisted by whatever provisions are made, both on national and regional levels.

It is towards this goal of assisting local organizations in preparing their own community estimates of the needs of manpower and material requirements for a desirable housing target that a procedure has been outlined below. In making such estimates it may be useful to observe the following five stages.

Stage 1. Determination of Standard Types

The types of houses—in terms of structures, building materials used and building standards—mostly commonly constructed in the locality, should be determined first. Types of houses of exceptional design that make up less than 1 per cent of the total can be excluded. In only a few communities will the common types of houses constructed exceed seventeen in number but allowance must be made for this factor where and when it occurs. After determining the most common types of houses constructed, a frequency distribution can be worked out by using applications for building permits or local assessment records. Where such data cannot be obtained from existing records, local builders might be able to provide the information needed.

Stage 2. Estimate of Building Material Requirements

If houses constructed in a locality fit the standard pattern given in this study, material requirements as shown in Tables VI-XXII in Appendix B can be used. Where the *average* type of house constructed in the locality is either larger or smaller than the standard type in terms of number of rooms or cubic foot content, appropriate adjustments have to be made. The same applies to cases where somewhat different standards are used, e.g., as in the case of houses built without basements. After the quantities have been determined, it will be necessary to check local building material prices against those shown in Tables VI-XXII. In most cases they will differ from those used here for reasons explained in the study (see Notes to Tables VI-XXII, Appendix A). Local prices of building materials will then have to be applied to units of building materials required, to obtain costs of building materials for the different types of houses built in that area. To obtain *total* building material requirements, a housing target in terms of number of units for one year has to be set, in the first instance arbitrarily. Preferably, the target should be expressed in terms of a range with upper and lower boundaries. Applying the frequency distribution obtained in Stage 1 to the target and multiplying the resulting numbers by the material requirements of the different types of units, sub-totals of material requirements for individual types are arrived at, which, added together, yield the total building material requirements in the area for one year.

Stage 3. Estimate of Total Construction Costs

These costs are made up of three major components: Outlay for building materials (including transportation costs to the site) are likely to vary between 50 and 55 per cent of total building costs; wage payments to on-site labour (including Unemployment Insurance contributions and payments to the Workmen's Compensation Fund) are likely to vary between 35 and 40 per cent; overhead and profits of builders and contractors will probably be in the neighbourhood of 10 per cent. However, the exact proportions will vary for different localities and, for this reason, have to be determined in each case. It might, for example, be found that in some communities overhead expenses and profits make up less than 10 per cent in housing developments, involving a large number of units, while they might be higher in cases of single unit construction, particularly in areas where the demand for new housing construction is great and the number of experienced contractors or builders is small.

Once the percentage distribution of the major components of construction costs has been determined, total construction costs can be worked out by applying the percentage to expenditures for building materials, determined in Stage 2.

Stage 4. Estimate of Construction Labour Requirements

The number of on-site man-hours, i.e., the number of hours worked on the site by persons employed in building a house, can be estimated by dividing total wage payments to construction workers, determined in Stage 3, by the average hourly wage rate commonly paid to construction workers in the locality. The average number of man-years provided by the number of houses to be built in that particular area in one year can be estimated by dividing the total number of on-site man-hours by a factor. This factor can be taken as 1,760 man-hours per year or 40 working weeks of 44 hours each if it is representative of working conditions in the area. If not, it has to be adjusted appropriately. The attempt to measure the importance of house building in a locality by the off-site employment provided is of less significance in an "area" approach than in considering a national program. Not all the building materials used on the site are produced locally but large portions of them are frequently transported to the place of construction from other parts of the country thus providing the bulk of employment in those areas and not in the localities where the houses are built. However, if so desired, a first approximation of off-site employment provided by the construction of a certain number of houses can be estimated by using a factor (see Note to Table 11, Appendix A).

Stage 5. Demand and Supply of Housing

Once the requirements for building materials and construction labour have been determined, it will be possible to revise the housing target which has been set arbitrarily in Stage 1. This can be done by setting forth the requirements as against supply of building materials and construction workers. Information of the latter sort can be obtained from building material manufacturers, supply houses, experienced builders and contractors, construction trade unions and National Employment Service Offices.

By comparing requirements with supply, it may be found that the first housing target set for the locality is either too large or too small. In the former case, shortages of building materials and construction labour might prevent the accomplishment of the target while in the latter instance there might be a surplus of certain kinds of building materials and unemployment among certain types of construction workers. If it is found that the target set in the first stage represents the minimum number of houses required and is backed by effective demand in the community, then the bottlenecks likely to be encountered in the execution

of the target have to be examined and appropriate action initiated to assure the building of as many houses as can be built by making maximum use of the capacity and the productive resources of that particular locality. If, on the other hand, it appears that there are likely to be surpluses of certain kinds of building materials—not likely to occur frequently in the immediate future—these can be made available through supply houses to other areas which might be badly in need of them. If there is likely to be an over-supply of construction workers, Employment Service Offices will be only too ready to advise such workers as to other job opportunities that might be open to them.

Thus, by advance consideration of the requirements of the housing program in a given locality and by matching these with the resources of the area, it will be possible to make maximum use of the productive facilities and the manpower in a locality and avoid waste in terms of manpower and materials. At the same time, any lengthy unemployment among construction workers and the holding of unused inventories of certain kinds of building materials when both workers and materials are badly needed in other areas can be avoided.